1993-94 AUTOMATIC TRANSMISSIONS

Model 098 Electronic Controls & Overhaul

APPLICATION

TRANSAXLE APPLICATION

Application	Transaxle Model
EuroVan	098

IDENTIFICATION

Transaxle type is cast into flat surface of transaxle case above valve body cover. Transaxle code and build date are located on front top of transaxle case.

DESCRIPTION & OPERATION

This transaxle includes a 4-speed automatic transaxle, a torque converter, a final drive and solenoid-operated valve body. See **Fig. 2** normal conditions, all shifts are controlled by a Transaxle Control Module (TCM). See **Fig. 5** gear is an overdrive gear.

NOTE: Transaxle uses a standard torque converter (with internal damper plate).

- **On early 1993 transaxles, the power flow in third gear changes depending on driving conditions. During 3rd gear (non-TCM controlled) and 4th gear operation, the 3rd-4th apply clutch is engaged. This locks the impeller shaft and small planetary drive shaft together, creating a direct coupling between the engine and transaxle. Overdrive (4th gear) is engaged by the 3rd-4th apply clutch and 2nd-4th brake clutch. During 3rd gear operation (TCM controlled), the transaxle engages 1st-3rd apply clutch and reverse clutch. This engages the turbine shaft to the large planetary drive shaft (through the 1st-3rd and reverse apply clutches), activating the torque converter.**
- **On late 1993 and 1994 transaxles, 3rd gear power flow occurs through 1st-3rd apply clutch and reverse gear clutch. Overdrive (4th gear) is engaged by the 3rd-4th apply clutch and 2nd-4th brake clutch.**

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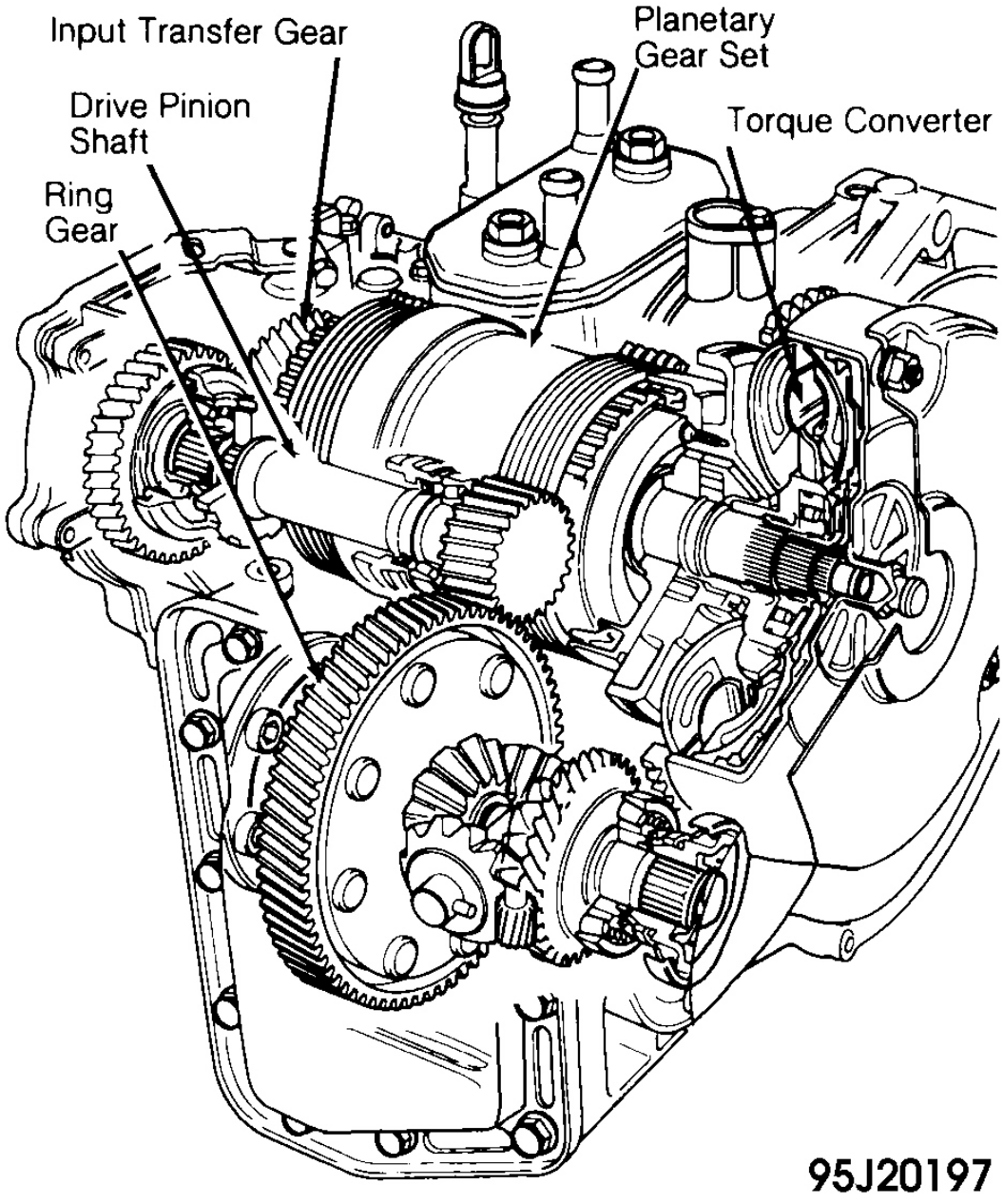

Fig. 1: Cross-Sectional View Of Transaxle Components
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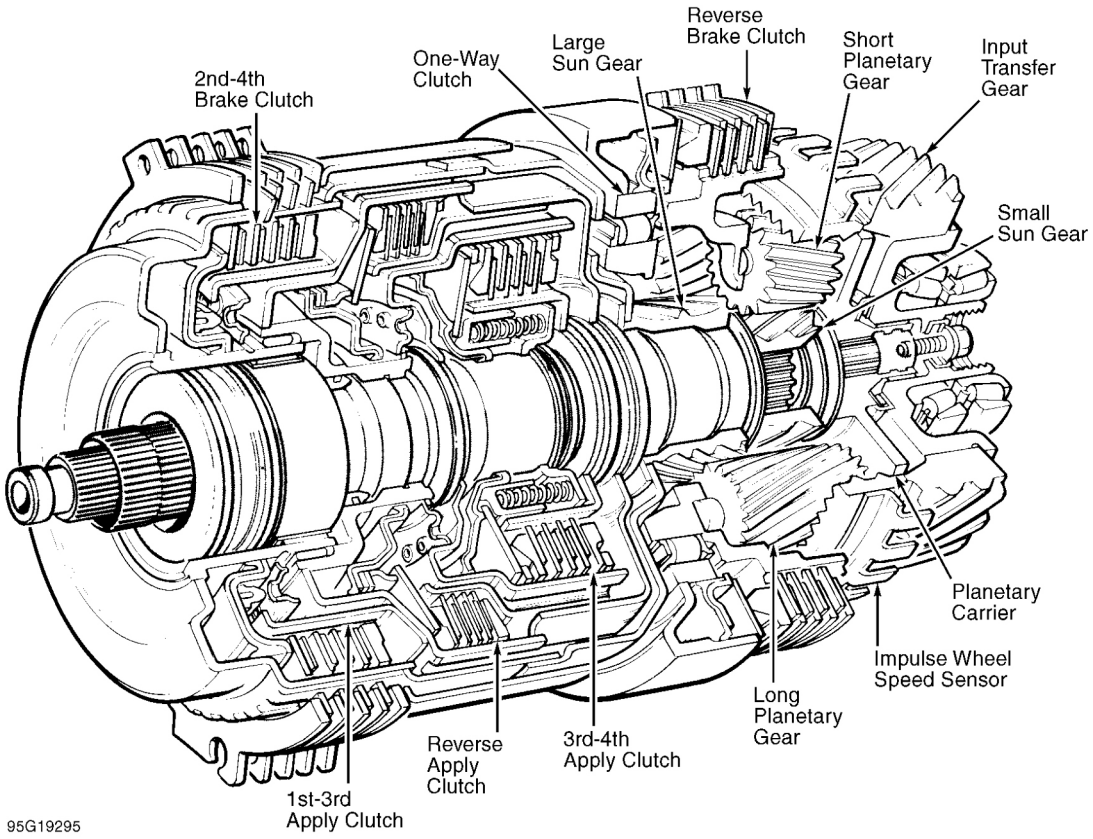

Fig. 2: View Of Transaxle Clutches, Shafts & Planetary Assemblies
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The transaxle elements consist of a planetary gear set, one-way roller clutch, 3 apply clutches and 2 brake clutches. See **Fig. 1** . Power from the transaxle is connected to the drive pinion through transfer gears. A ring gear and differential assembly are connected to flanges which spin the drive axles.

The electronic control consists of a TCM (located in right footwell area, by "A" pillar), control solenoids, various sensors and switches. The control solenoids direct oil pressure inside the valve body. Solenoid valves No. 1-4 control the apply and brake clutches. Solenoid valves No. 5 and 7 control shift smoothness.

Control solenoid valve No. 6 is a frequency valve and controls the main hydraulic pressure. The TCM controls the main hydraulic pressure by varying the duty cycle.

On early 1993 models, a program switch button (located on gear selector console) changes the shift program. When the program switch button is pressed (sport mode), this signals the TCM to change the shift program. On late 1993-94 models, the program switch is deleted.

The TCM monitors input and output signals. If electrical problems occur, TCM will record faults in TCM memory and may go into fail-safe mode. If TCM enters fail-safe mode, the transaxle will operate manually in reverse, 1st or 3rd gear. In fail-safe mode, 3rd gear operates with gear selector in 2nd, 3rd or "D". The TCM memory can only be read on Tester (VAG 1551/1).

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The TCM also controls shift lock system. This system locks the gear selector in Park or Neutral unless the brake pedal is pushed down. The TCM uses a shift lock control relay to release a gear-selector mounted solenoid.

LUBRICATION

LUBRICATION

See **SERVICING** article.

ON-VEHICLE SERVICE

AXLE SHAFTS

See appropriate FWD AXLE SHAFTS article in DRIVELINE/AXLES.

OIL COOLER FLUSHING

1. Remove external oil filter. Remove oil lines and allow fluid to drain. Using pressurized solvent, flush remaining fluid and debris from oil lines and cooler. Repeat flushing if necessary.
2. Use pressurized shop air to remove solvent from oil lines and oil cooler. Install a NEW external oil filter.

TRANSAXLE COMPONENTS

The following components may be serviced with the transaxle in the vehicle. For removal and installation procedures, refer to **TRANSAXLE DISASSEMBLY** .

- Drive Flanges
- External Oil Filter
- Gear Selector Lever
- Multifunction Switch, Speedometer Drive Shaft & Speed Sensor
- Oil Pan & Valve Body Assembly
- Planetary Gear Cover

ADJUSTMENTS

NOTE: For additional adjustment information, see SERVICING article.

NOTE: Perform the following adjustments in order given.

SHIFT CONTROL CABLE

Loosen lock screw at gear selector lever in shift control housing. Move gear selector in center console to "P" position. Ensure front wheels are locked. Tighten cable housing to gear selector lever lock screw to specification. See **Fig. 3** .

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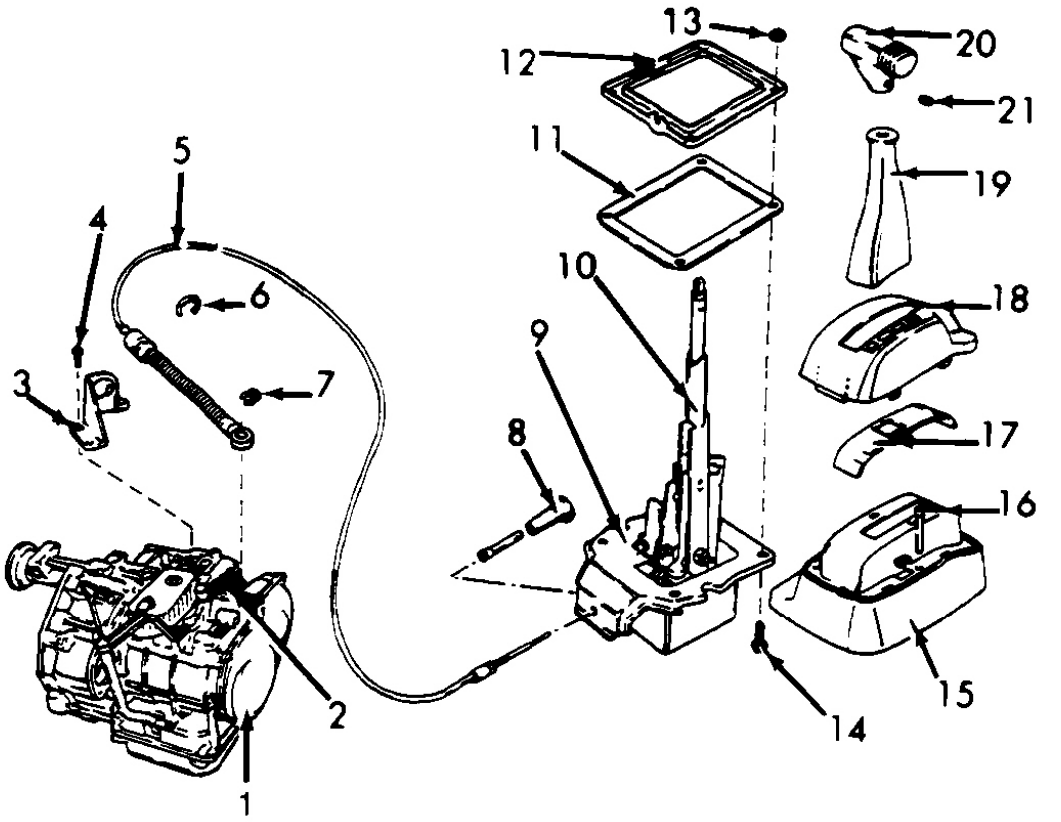

Fig. 3: Adjusting Control Cable
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SHIFT LOCK CABLE

1. Move gear selector to "P" position. Turn ignition key to HALT position and release. Loosen both lock nuts.
2. Press locking lever to touch selector lever. See **Fig. 4** . Tighten lock nut No. 2 tight while holding locking lever. Tighten lock nut No. 1 against lock No. 2. Ensure gear selector operation is correct.

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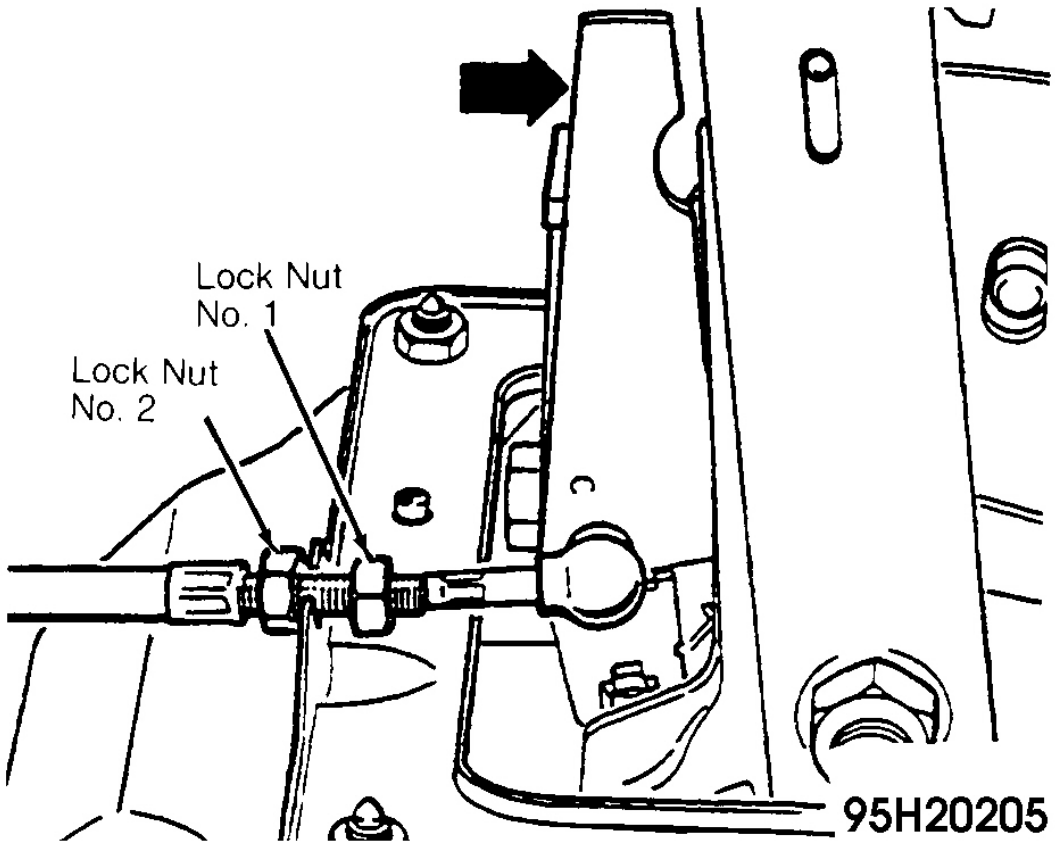

Fig. 4: Adjusting Shift Lock Cable
Courtesy of VOLKSWAGEN UNITED STATES, INC.

TROUBLE SHOOTING

PRELIMINARY INSPECTION

1. If gear selector is stuck in Park or Neutral, proceed to **SHIFT LOCK SYSTEM** . If gear positions are missing, shift quality is poor or no shifts are possible, ensure all electrical connections are okay and fluid level is correct.
2. If problems are still present, disconnect electrical connector at transaxle. Test drive vehicle. Check if transaxle will operate manually in reverse and 1st gear. Move gear selector to 2nd, 3rd or "D" position. Transaxle should operate in 3rd gear (2nd, 3rd or "D").
3. If transaxle operates as described, problem may be electrical. See **ELECTRONIC SELF-DIAGNOSTICS** . If transaxle does not operate as described, problem may be mechanical or hydraulic. See **ROAD TEST** under TESTING.

NOTE: If transaxle does not operate in manual 1st gear, check 1st-3rd apply clutch and

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reverse brake clutch for damage or wear. If transaxle does not operate in manual reverse gear, check reverse apply clutch and reverse brake clutch for damage or wear.

SYMPTOM DIAGNOSIS

Leak At Torque Converter

Check drive plate clearance, torque converter bushing, oil seal or oil pump assembly. Repair as necessary.

Transaxle Fluid in Coolant

Faulty transaxle oil cooler. Replace transaxle oil cooler and friction plates in transaxle. Clean transaxle.

Transaxle & Differential Oils Mixed

Replace "O" ring and drive pinion seal on inner bearing support.

Gear Selector Hard To Move

Check gear selector between shifter and transaxle. Repair as necessary. Check parking lock assembly inside transaxle. Repair as necessary.

No Drive In 1st Gear

Check for faulty 1st-3rd apply clutch or reverse brake clutch.

No Drive In "D", "2" Or "3"

Check for faulty 1st-3rd apply clutch or one-way clutch.

No 2nd Gear In "D", "2" Or "3"

Check for faulty 2nd-4th brake clutch.

No 3rd Gear In "D" Or "3"

Check for faulty reverse apply clutch.

No 4th Gear In "D" (Early 1993 Only)

Check for faulty 4th gear and 2nd-4th brake clutch.

No 4th Gear In "D" (Late 1993-94)

Check for faulty 2nd-4th brake clutch.

No Reverse

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Check for faulty reverse apply clutch or reverse brake clutch.

No Drive In All Forward Gear Positions

Check for faulty 1st-3rd apply clutch, reverse brake clutch or one-way clutch.

Missing Shifts Up Or Down

Check valve body for sticking valve(s) or faulty shift solenoid(s).

Erratic Or Harsh Shifts

Short in wiring to shift solenoid(s) or faulty shift solenoid(s).

Harsh Shift In One Gear Only

Determine elements involved. Air check elements. Check for faulty shift solenoid or shift valve.

Stuck In Emergency Running Mode

Check for incorrect TCM installed, faulty wiring, bad solenoid electrical strip (inside oil pan) or stuck valve.

Park Lock Will Not Engage

Check for misadjusted selector lever cable. Check for faulty locking mechanism.

Bucking Or Poor Idling

Check throttle housing and air ducts of leaks. Check for possible air entering oil pump pickup.

Excess Engine RPM Drop When Shifting Into 1st Gear

Faulty Engine Control Module (ECM).

Engine Starts In Gear Or No Start In Park/Neutral

Check for faulty Park/Neutral safety switch.

Shift-Lock Not Holding Selector In Park/Neutral

Check for faulty shift lock solenoid, shift lock mechanism or bad TCM.

Program Switch Malfunction

Check for faulty switch, related wiring or connections.

CLUTCH & BRAKE APPLICATION

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CLUTCH & BRAKE APPLICATION (EARLY 1993)

Gear Selector Position	Elements In Use
"D" (Drive)	
1st Gear	1st-3rd Apply & One-Way Clutch Holding
2nd Gear	1st-3rd Apply & 2nd-4th Brake
3rd Gear (1)	1st-3rd & Reverse Apply Clutches
4th Gear	3rd-4th Apply & 2nd-4th Brake
3rd (Drive)	
1st Gear	1st-3rd Apply & One-Way Clutch Holding
2nd Gear	1st-3rd Apply & 2nd-4th Brake
3rd Gear (1)	1st-3rd & 3rd-4th Apply Clutches
3rd (Manual)	
3rd Gear (2)	1st-3rd Apply, 3rd-4th & Reverse Apply
2nd (Drive)	
1st Gear	1st-3rd Apply & One-Way Clutch Holding
2nd Gear	1st-3rd Apply & 2nd-4th Brake
1st (Manual)	
1st Gear	1st-3rd Apply & Reverse Brake
Reverse	Reverse Apply & Reverse Brake
Park & Neutral	All Apply & Brake Clutches Released Or Ineffective

(1) 1st-3rd and reverse apply clutches are engaged. However, main power path is the 3rd-4th apply clutch.

(2) These elements are in use during TCM fail-safe mode.

CLUTCH & BRAKE APPLICATION (LATE 1993 & 1994)

Gear Selector Position	Elements In Use
"D" (Drive)	
1st Gear	1st-3rd Apply & One-Way Clutch Holding
2nd Gear	1st-3rd Apply & 2nd-4th Brake
3rd Gear	1st-3rd & Reverse Apply Clutches
4th Gear	3rd-4th Apply & 2nd-4th Brake
3rd (Drive)	
1st Gear	1st-3rd Apply & One-Way

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	Clutch Holding
2nd Gear	1st-3rd Apply & 2nd-4th Brake
3rd Gear	1st-3rd & Reverse Apply Clutches
2nd (Drive)	
1st Gear	1st-3rd Apply & One-Way Clutch Holding
2nd Gear	1st-3rd Apply & 2nd-4th Brake
1st (Manual)	
1st Gear	1st-3rd Apply & Reverse Brake
Reverse	Reverse Apply & Reverse Brake
Park & Neutral	All Apply & Brake Clutches Released Or Ineffective

SHIFT LOCK SYSTEM

Operation

All models are equipped with an electronic shift lock system. TCM controls shift lock system. See **Fig. 5** . The system locks gear selector in Park or Neutral position unless brake pedal is pushed down. TCM uses shift lock control relay to release a solenoid mounted on gear selector assembly.

NOTE: Shift lock relay will not lock gear selector when vehicle speed is greater than 3 MPH.

A mechanical control cable prevents ignition key from being removed unless gear selector is in Park. With ignition key removed, gear selector locks in Park.

NOTE: If battery is disconnected or discharged, gear selector can be moved out of Park by turning ignition key to START position.

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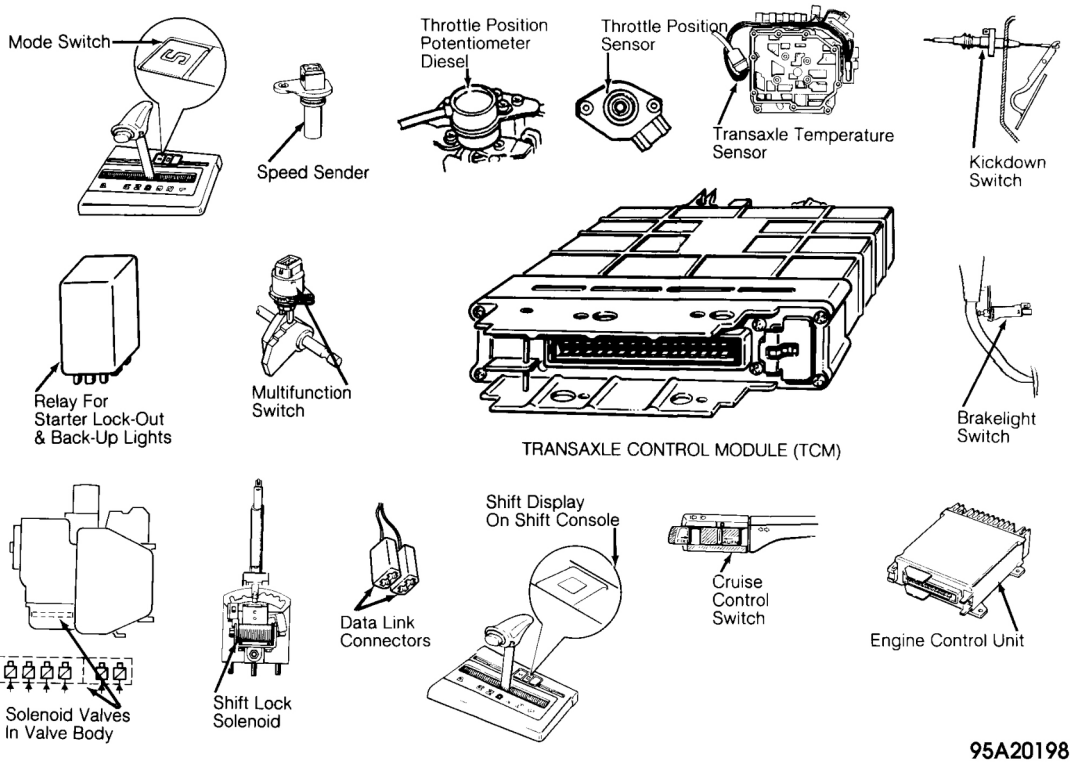

Fig. 5: Identifying TCM & Shift Lock Electrical Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Functional Check

1. With ignition key removed, ensure gear selector cannot be moved from Park. Insert key in ignition switch.
2. Turn ignition switch on. Ensure gear selector can only be moved with brake pedal pressed down. Move gear selector to Neutral position.
3. Without pressing brake pedal, ensure gear selector cannot move out of Neutral. Press brake pedal down. Ensure it is now possible to move gear selector.
4. If shift lock system does not operate as described, adjust gear selector, solenoid and control cable. If shift lock system does not operate after adjustments are made, check electrical system of shift lock system with Tester (VAG 1551/1).
5. See testing information under **ELECTRONIC SELF-DIAGNOSTICS** . See **VOLTAGE TEST** and **RESISTANCE TEST** under TESTING. If any problems are found, service harness or components. If no problems are found, TCM may be defective. If shift lock system still does not operate correctly, check for worn or damaged parts and replace as necessary. See **Fig. 6** .

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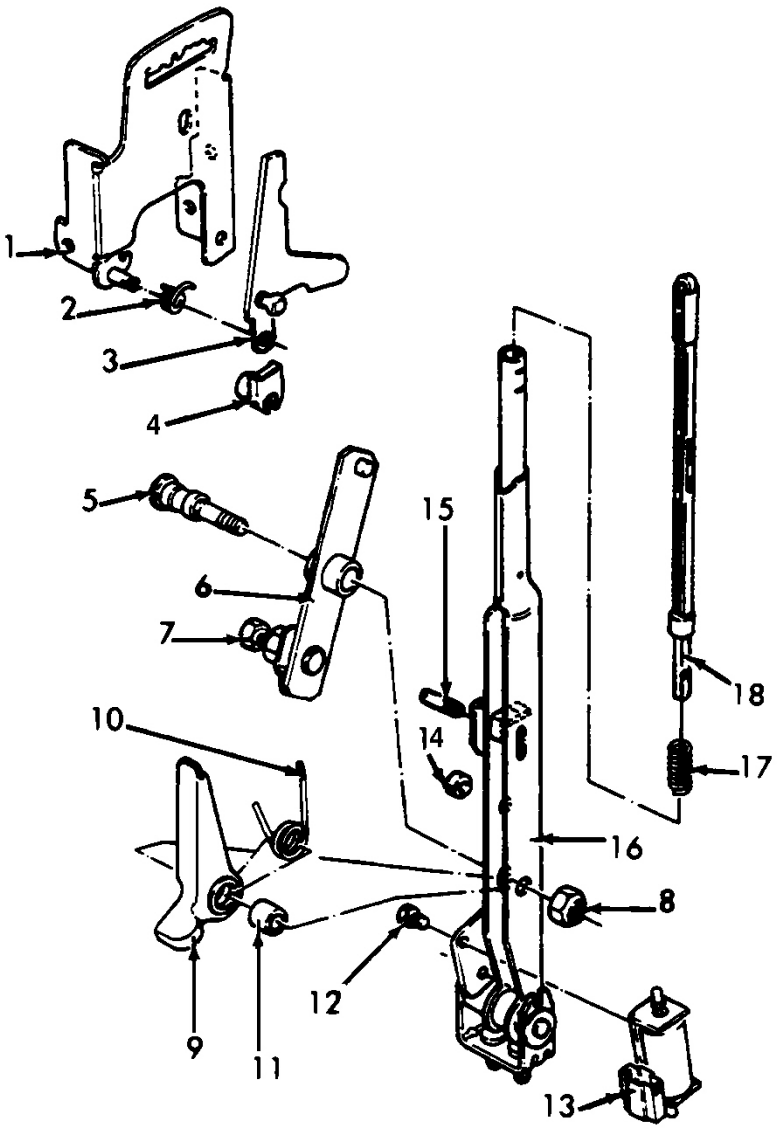

1. Detent Segment
2. Spring
3. Locking Lever
4. Bearing Plate
5. Collar Screw
6. Relay Lever
7. Shouldered Bolt
8. Self-Locking Nut
9. Locking Lever
10. Spring
11. Bushing
12. Bolt
13. Shift Lock Solenoid
14. Sliding Block
15. Stud
16. Selector Lever
17. Spring
18. Push Rod

Fig. 6: Exploded View Of Shift Lock & Gear Selector Assembly
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TESTING

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ROAD TEST

1. Road test vehicle. Move program switch (if equipped), located next to shift indicator on dash, to NORMAL position (light off). From a stop, perform full throttle upshifts with transaxle in "D". Note upshift speeds.
2. With vehicle at a speed above kickdown speed, press throttle pedal down and note kickdown shift speeds. Repeat road test with program switch (if equipped) in "S" position, (light on). Compare vehicle shift speeds. Ensure full throttle upshift speeds are higher with program switch in "S" position, for all shifts. Ensure kickdown shift speeds are approximately the same with program switch in either position.
3. If transaxle does not operate as described, determine affected elements. See **CLUTCH & BRAKE APPLICATION** under TROUBLE SHOOTING.
4. If all apply and brake clutch elements are affected, check oil pump, oil filter, cooler lines, solenoid valve No. 6, operation of program switch (if equipped), condition of torque converter and/or engine. Repair as necessary.
5. If one or more apply and brake clutch elements are affected, remove valve body. Locate appropriate fluid circuit in transaxle case and valve body. See **Fig. 7** -**Fig. 13** . Check for leaks and blockage. Repair as necessary.
6. If hydraulic circuits are okay or problems with apply and brake clutch elements are mechanical, repair transaxle.

NOTE: If transaxle does not operate in manual 1st gear, check 1st-3rd apply clutch and reverse brake clutch for damage or wear. If transaxle does not operate in manual reverse gear, check reverse apply clutch and reverse brake clutch for damage or wear.

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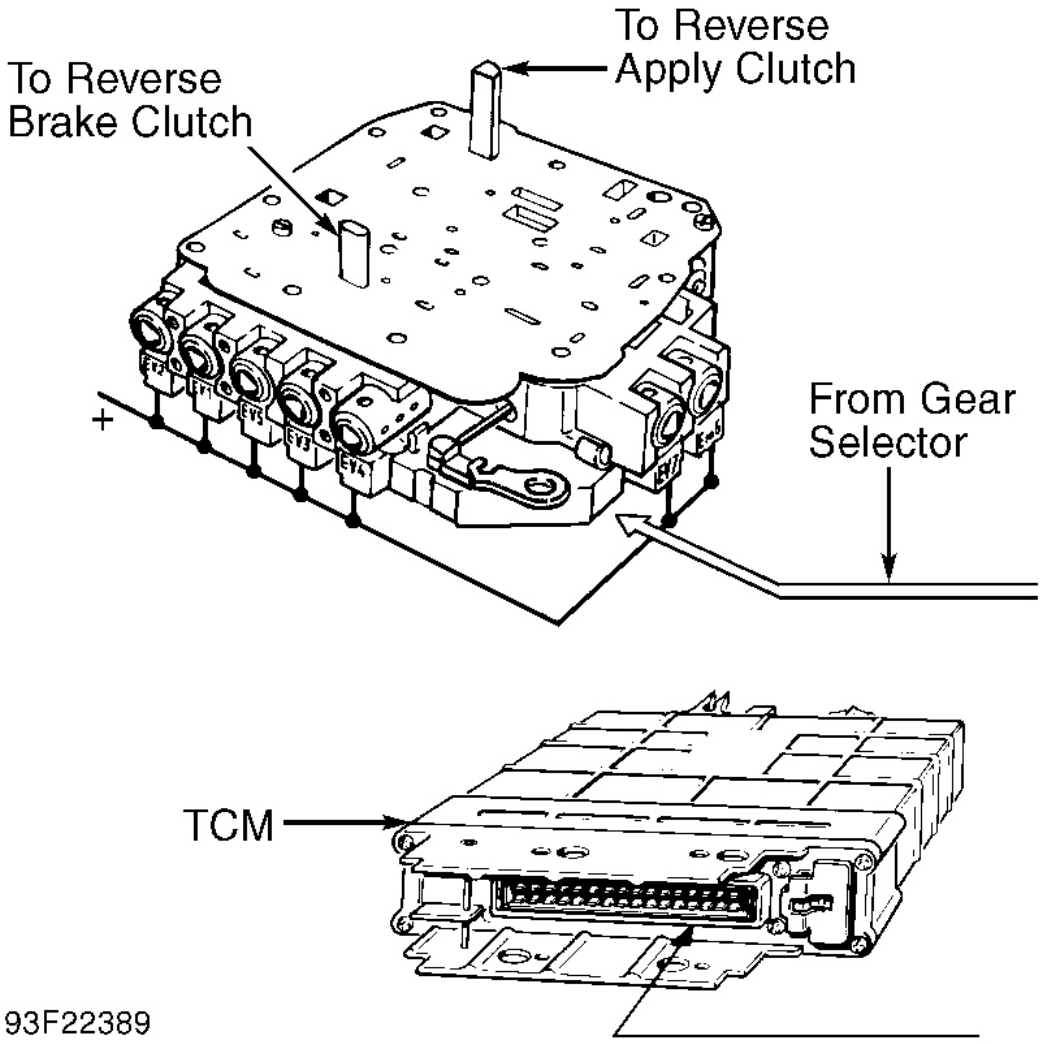

Fig. 7: Reverse Gear Oil Circuits
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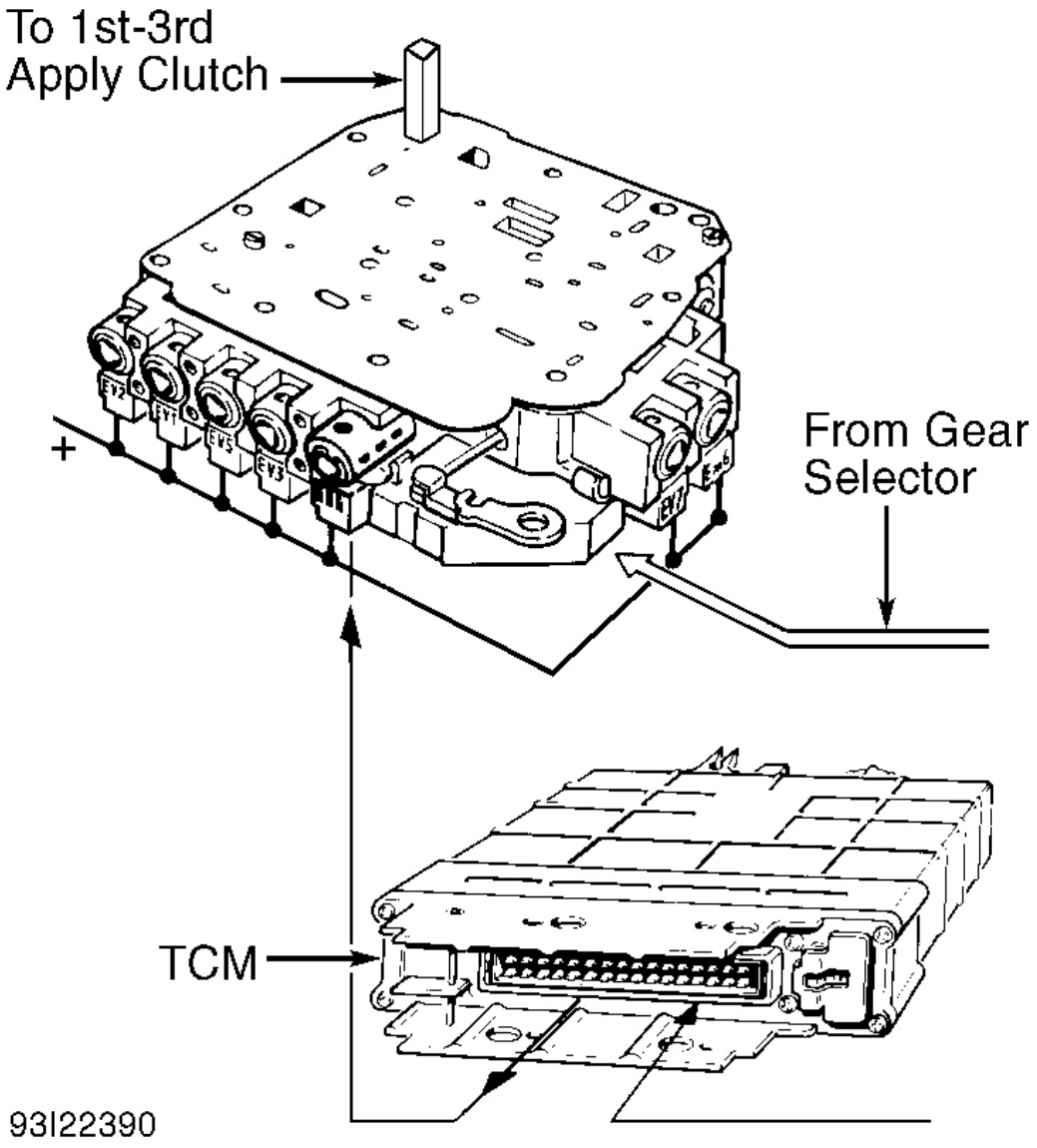

Fig. 8: 1st (In "D") Gear Oil Circuits
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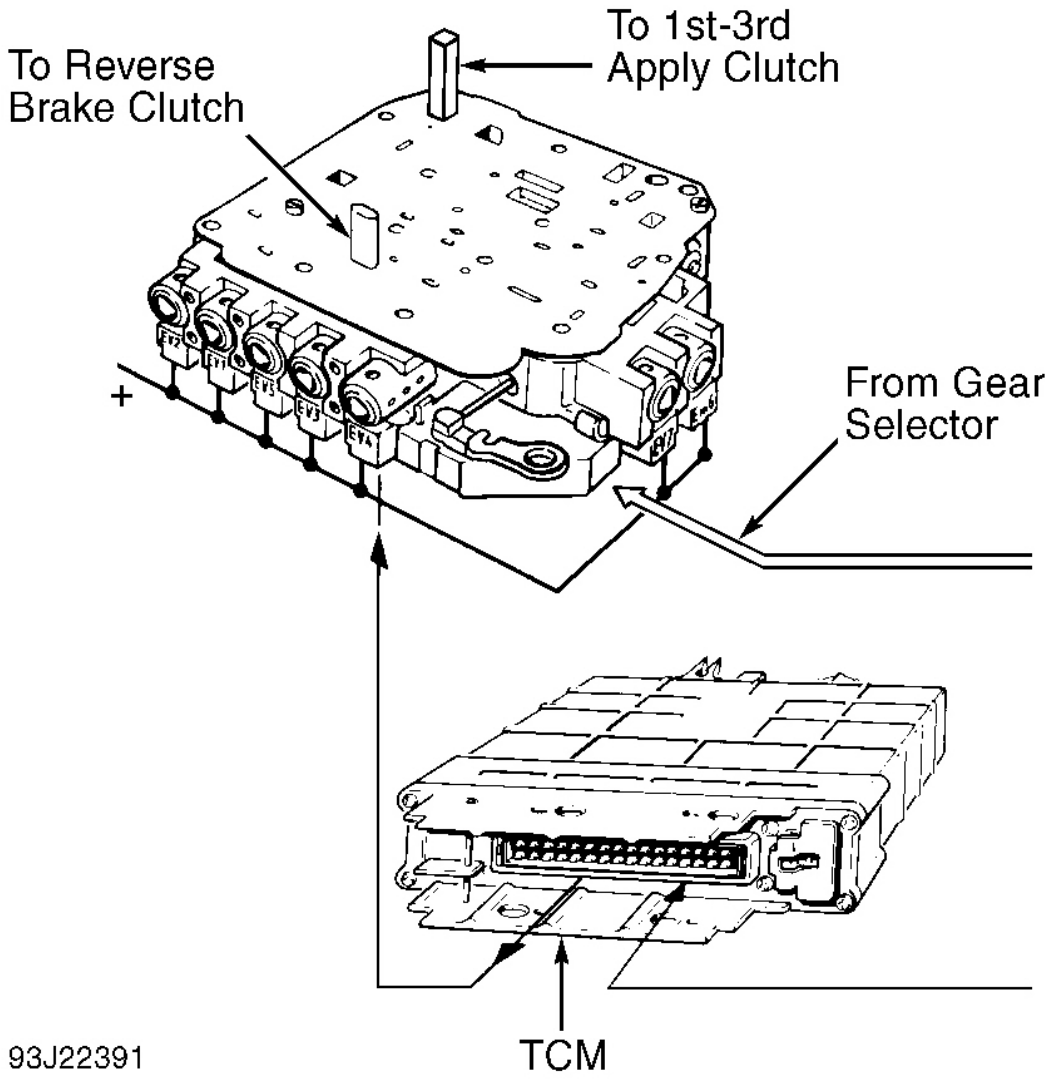

Fig. 9: 1st (In Manual 1st) Gear Oil Circuits
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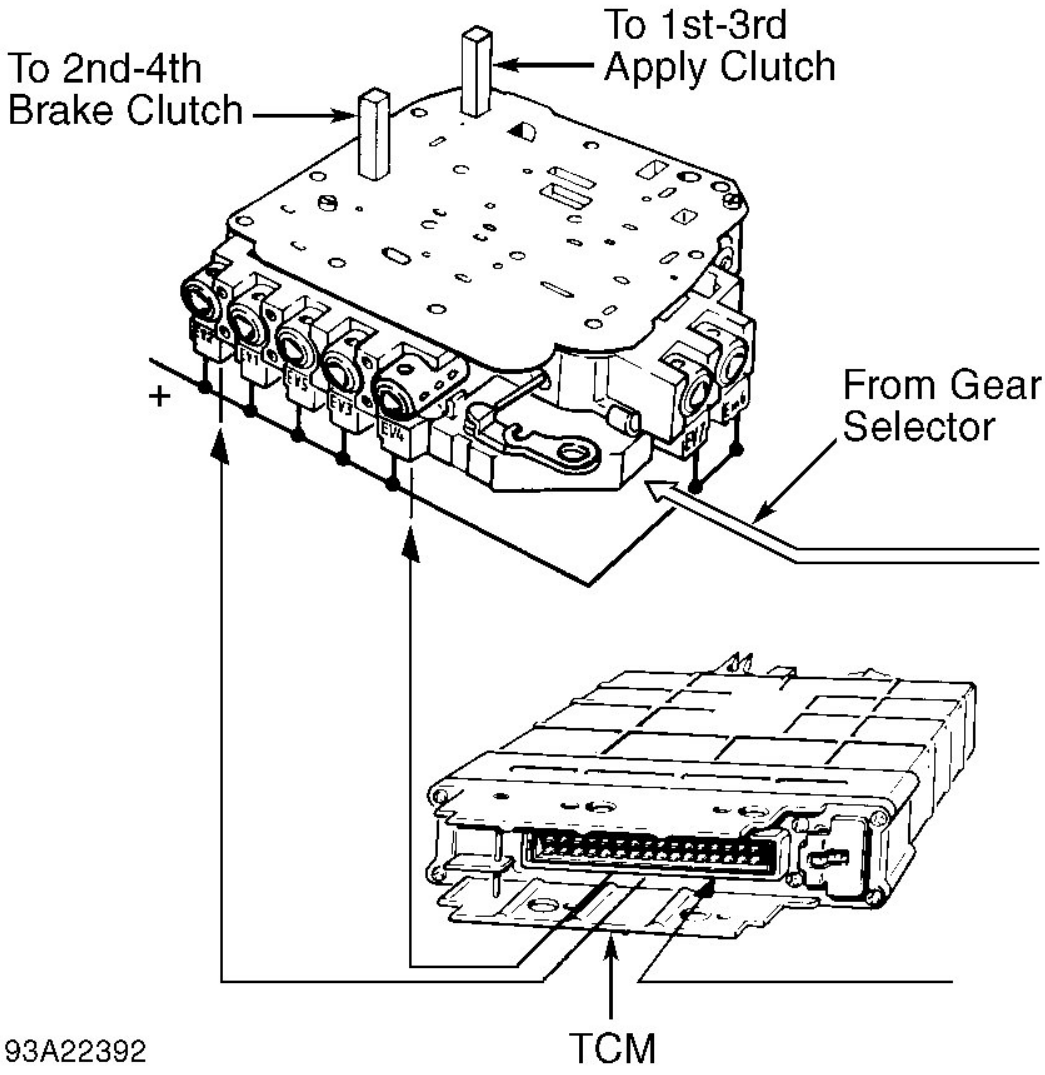

Fig. 10: 2nd Gear Oil Circuits
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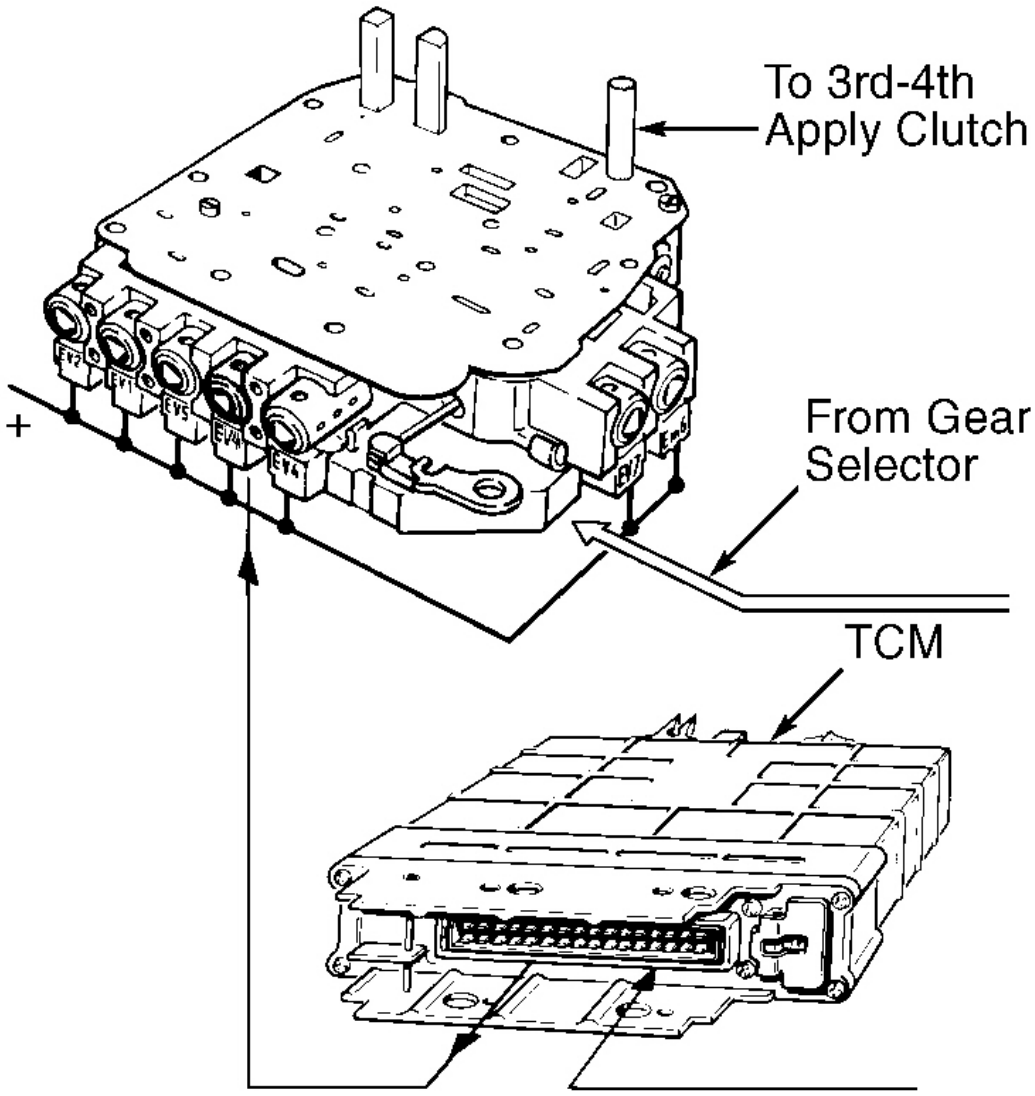

Fig. 11: 3rd (In "D") Gear Oil Circuits
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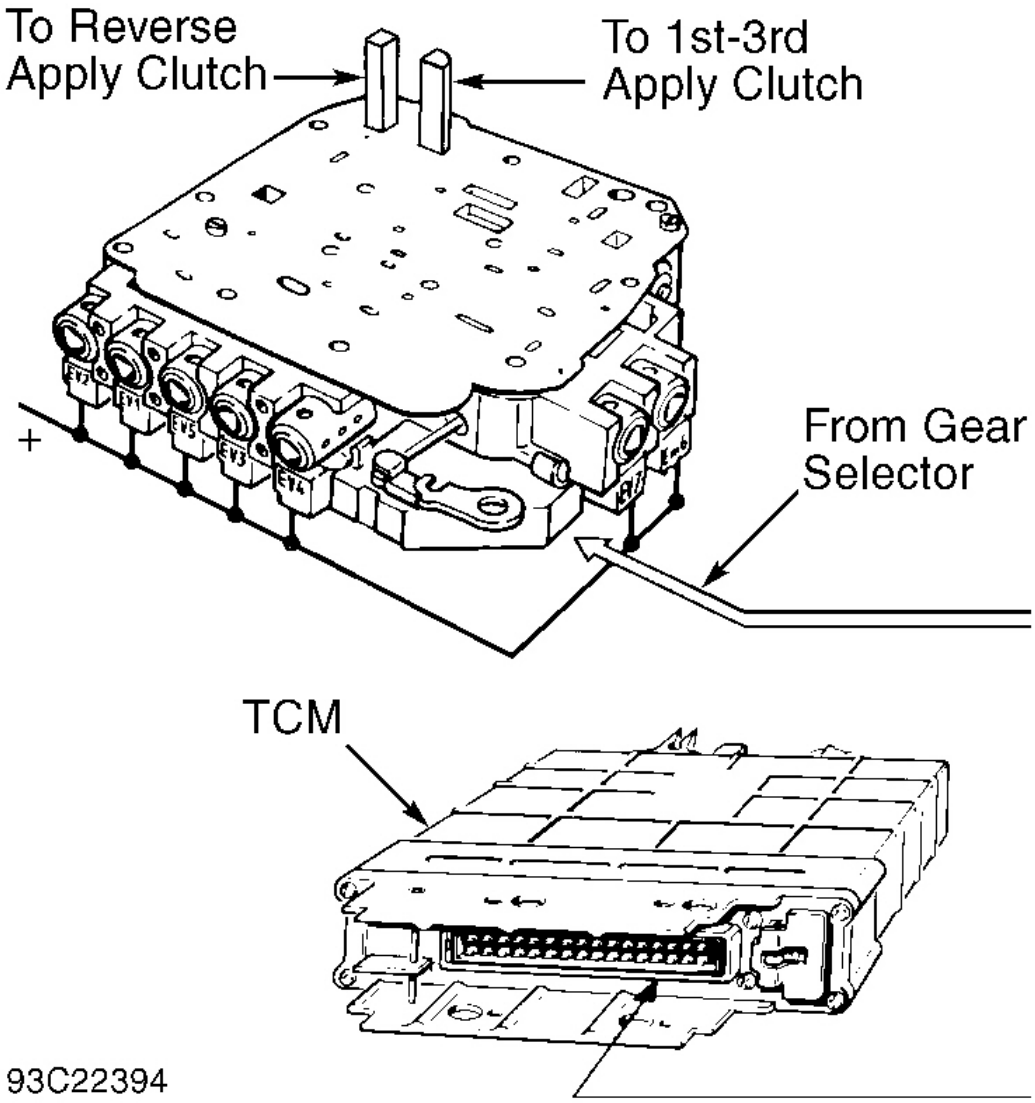

Fig. 12: 3rd (In Manual) Gear Oil Circuits
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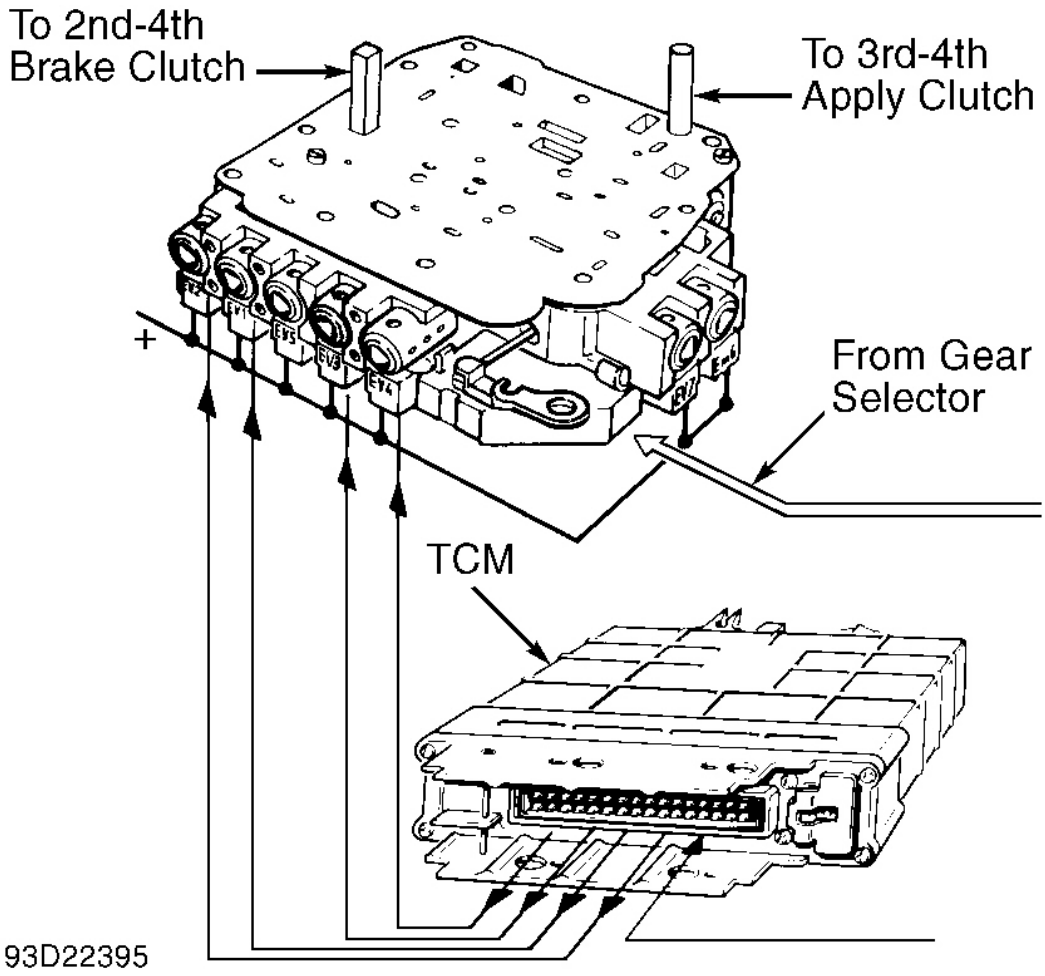

Fig. 13: 4th Gear Oil Circuits
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HYDRAULIC PRESSURE TEST

Check operation of apply and brake clutches by air checking fluid passages of valve body and transaxle case. See **Fig. 7** . Install pressure gauge to transaxle pressure tap located near dipstick tube. Check main hydraulic pressure under normal driving conditions. See the **MAIN PRESSURE SPECIFICATIONS** table. If main hydraulic pressures are not correct, check for excess idle speed, problem with pump or sticking valves in valve body. Repair any problems found.

MAIN PRESSURE SPECIFICATIONS

Application	psi (Bar)
"D"	
Idle RPM	49-55 (3.4-3.8)

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2000 RPM (1)	146-164 (10.1-11.3)
"R"	
Idle RPM	94-109 (6.5-7.5)
2000 RPM (1)	334-348 (23.0-24.0)
(1) With solenoid valve connector disconnected. After test, reconnect solenoid valves and using Tester (VAG 1551/1), erase trouble codes from memory.	

STALL SPEED TEST

NOTE: Information not provided by manufacturer.

ELECTRONIC SELF-DIAGNOSTICS

1. Electronic control consists of a TCM (under right front footwell by "A" pillar), control solenoids, and various sensors and switches. TCM monitors input and output signals. See **Fig. 5** .
2. If TCM detects problems in transaxle-related circuits or devices, TCM may record a trouble code in memory. To obtain trouble codes, use Tester (VAG 1551/1). All trouble code and related testing information are contained in tester.
3. If tester is not available, turn ignition off and disconnect battery. Disconnect TCM harness connector. Install Back-Probe Harness (VAG 1598) and VAG Adapter (1598/9) between TCM and TCM harness.
4. Measure voltage and resistance between specified terminals of TCM connector. See **ELECTRICAL TEST** under CIRCUIT TESTS. If problem is found, service harness or components. If no problem is found, TCM may be defective.

CIRCUIT TESTS

ELECTRICAL TEST

1. Manufacturer does not provide electrical component tests or specifications. All testing information is contained in Tester (VAG 1551/1).
2. If Tester (VAG 1551/1) is not available, turn ignition off and disconnect battery. Disconnect TCM harness connector. Install Back-Probe Harness (VAG 1598) between TCM and TCM harness.
3. Measure voltage specified terminals of TCM connector. See **VOLTAGE TEST** . Measure resistance between specified terminals of TCM connector. See **RESISTANCE TEST** . If any problems are found, service harness or components. If no problems are found, TCM may be defective.

Voltage Test

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Voltage Test Specifications (Table 1)

Sockets On VAG 1598	Area To Be Tested	Testing Requirements & Additional Steps	Test Result Specs	If Test Results NOT Not Within Specs
19 + 1	Transaxle TCM Voltage Supply	Switch Ignition On	About Battery Voltage	Check Wire From Terminal 1 Check Wire From Terminal 19 For Continuity W/ C/15A In Relay Panel
10 + 29	Throttle Valve Potentio-meter	Switch Ignition On Disconnect Throttle Valve Potentio-meter	4.6-5.0 Volts	Replace TCM
9 + 29		No Throttle Full Throttle	0.3 Volts (min.) 4.5 Volts (Max.)	Calibrate Valve Potentiometer Replace If Necessary
19 + 20	Solenoid Switch For Shift Interlock	Switch Ignition On Selector Lever In P or N Brakes Applied	About Battery Voltage 0 Volts	Replace TCM Check Signal From Brake Light Switch Replace TCM If Necessary
26 + 1	Signal From Brake Light Switch	Switch Ignition On DO NOT Apply Brakes Brakes Applied	0 Volts About Battery Voltage	Check Brake Light Switch Wiring

Fig. 14: Voltage Test Specifications (1 Of 2)

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Voltage Test Specifications (Table 2)

VAG 1598 Terminals	Component To Be Tested	Testing Conditions & Additional Steps	Test Result Specs	If Test Results NOT Not Within Specs
34 + 1	Multi-Function Switch	Switch Ignition On Move Selector Lever To Position N, D, 2 & 3	4.5-5 Volts	Check Wire Routing Replace Multi-Function Switch
		Move Selector Lever To Position P & 1	0-0.8 Volts	
15 + 1		Move Selector Lever To Position P,R,2 &1	4.5-5 Volts	
		Move Selector Lever To Position N,D & 3	0-0.8 Volts	
35 + 1		Move Selector Lever To Position P,R,N &D	4.5-5 Volts	
		Move Selector Lever To Position 3,2 & 1	0-0.8 Volts	
16 + 1		Move Selector Lever To Position P,R,N &D	About Bat Voltage	
		Move Selector Lever To Position 3,2 & 1	0-0.8 Volts	

Fig. 15: Voltage Test Specifications (2 Of 2)

Resistance Test

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Voltage Test Specifications (Table 3)

Sockets On VAG 1598	Area To Be Tested	Testing Requirements & Additional Steps	Test Result Specs	If Test Results NOT Not Within Specs
22 + 18	Solenoid Valve 1	Switch Ignition Off TCM Disconnected	55-65 Ohms Open	Check Harness Replace Multi-Function Switch
22 + 1				
23 + 18	Solenoid Valve 2			
23 + 1				
3 + 18	Solenoid Valve 3			
3 + 1				
2 + 18	Solenoid Valve 4			
2 + 1				
24 + 18	Solenoid Valve 5			
24 + 1				
25 + 18	Solenoid Valve 6		4.5-6.5 Ohms	
25 + 1			Open	
21 + 18	Solenoid Valve 7		55-65 Ohms	
21 + 1			Open	

Fig. 16: Resistance Test Specifications (1 Of 2)

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Voltage Test Specifications (Table 4)

VAG 1598 Terminals	Component To Be Tested	Testing Conditions & Additional Steps	Test Result Specs	If Test Results NOT Not Within Specs
19 + 20	Solenoid Switch for Shift Interlock	Switch Ignition Off TCM Disconnected	14-25 Ohms	Check Harness Routing Replace Magnet for Shift Interlock
1 + 17	Kickdown Switch	Switch Ignition Off TCM Disconnected DO NOT Press Accelerator Pedal	Open	Check Harness Routing Adjust or Replace Accelerator Cable
		Depress Accelerator Fully	Less Than 1.5 Ohms	
32 + 33	Vehicle Speed Sensor	Switch Ignition Off TCM Disconnected Set Ohmmeter To 2 k/ohm Scale	800-900 Ohms	Check Harness Routing Replace Vehicle Speed Sensor
36 + 1	Program Switch	Switch Ignition Off TCM Disconnected Set Ohmmeter To 200-Ohm Scale Program Switch Not Activated	Open	Check Harness Routing Replace Program Switch
		Program Switch Activated	Less Than 1.5 Ohms	
30 + 18	ATF Temperature Sensor	Switch Ignition Off TCM Disconnected Set Ohmmeter To 200k/ohm Scale ATF Temperature 20°C(68°F)	About 24,700 Ohms	Check Harness Routing Replace ATF Temperature Sensor
		ATF Temperature 60°C(140°F)	About 48,800 Ohms	
		ATF Temperature 120°C(216°F)	About 7400 Ohms	
27 + 28	RPM Sensor (Diesel)	Switch Ignition Off TCM Disconnected Set Ohmmeter To 2k/ohm Scale	1000 Ohms	Check Harness Routing Replace RPM Sensor

Fig. 17: Resistance Test Specifications (2 Of 2)

REMOVAL & INSTALLATION

CONTROL CABLE

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Removal & Installation

Remove cover from center console. Remove circlip from control cable end at transaxle. Remove control cable from shift lever on transaxle. Remove lock nut at shift control housing and remove cable. To install, reverse installation and adjust control cable.

SHIFT LOCK CABLE

Removal & Installation

1. Remove shift lever handle. Remove center console cover. Disconnect negative battery cable and wait 30 seconds.
2. Disconnect shift lock cable at frame and remove ball head of locking lever. Remove cover from ignition switch. Remove spring clip holding cable housing to ignition assembly.
3. Remove cable from ball head at ignition assembly. See **Fig. 18** .

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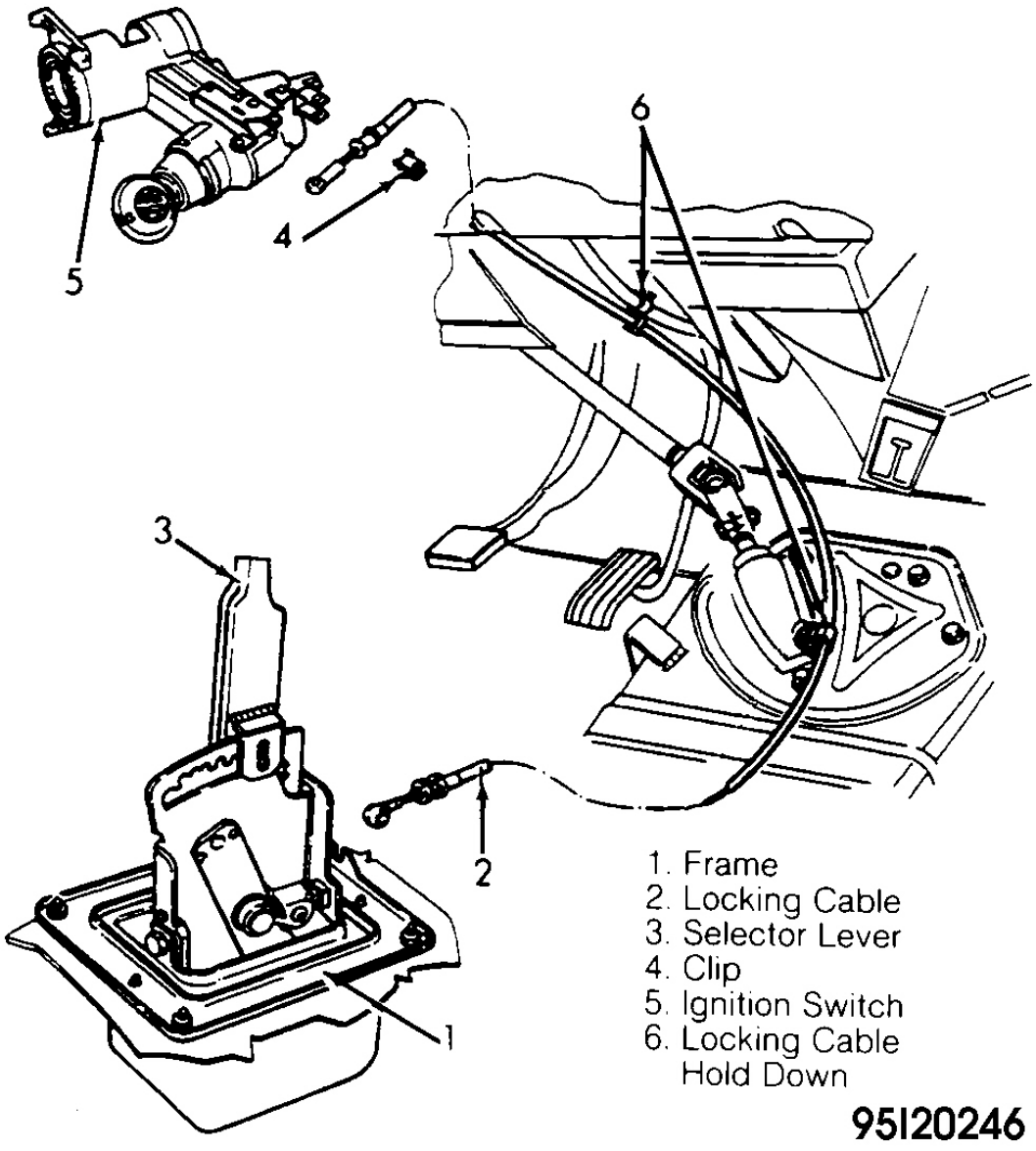

Fig. 18: Removing Shift Lock Cable From Shift Lever Support
Courtesy of VOLKSWAGEN UNITED STATES, INC.

4. Remove shift-lock cable from under dash near A/C-heater housing and remove from vehicle. To install, position shift lock cable through under-dash panels. Reverse removal procedure to complete installation. Adjust shift lock control cable. See **SHIFT LOCK CABLE** under ADJUSTMENTS.

TRANSAXLE

NOTE: See REMOVAL & INSTALLATION article.

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TORQUE CONVERTER

1. Remove torque converter. Check torque converter for any wear or damage, and replace if necessary. If torque converter is being reused, drain old fluid.
2. Slightly tilt torque converter on bench. Place a .53-gallon (2.0L) plastic bottle below torque converter.
3. Create a small round hole in bottle cap. Ensure outside diameter of a small hose fits tightly in bottle cap. Insert hose into bottle cap, and install cap and hose on bottle.
4. Squeeze bottle and place other end of hose into torque converter. Release bottle and allow fluid to drain in bottle. Loosen bottle cap, and allow remaining fluid to siphon into bottle.

TRANSAXLE DISASSEMBLY

TRANSAXLE ASSEMBLY

1. Remove torque converter. Remove oil pan and valve body assembly. Remove sealing plug from transaxle case. See **Fig. 20** .
2. Measure and record turbine shaft end play. See **Fig. 21** . Remove oil pump bolts. Using 2 M8 bolts, press oil pump from front of transaxle. See **Fig. 22** .
3. Remove turbine shaft complete with 2nd-4th brake clutch, support tube, 1st-3rd and reverse apply clutch assemblies. Remove impeller shaft and 3rd-4th apply clutch assembly. See **Fig. 19** .
4. Remove planetary cover from transaxle case. Engage parking gear. Using a screwdriver, lock small sun gear drive shell to large sun gear drive shell. See **Fig. 24** . Remove bolt from end of small planetary drive shaft, and remove shaft.
5. Remove small sun gear drive shell, large sun gear drive shell, circlips and one-way clutch. Remove planetary carrier and bearing assembly. See **Fig. 25** . Remove reverse brake clutch assembly. See **Fig. 25** . Do not remove input gear assembly, unless bearing or gear damage is present.

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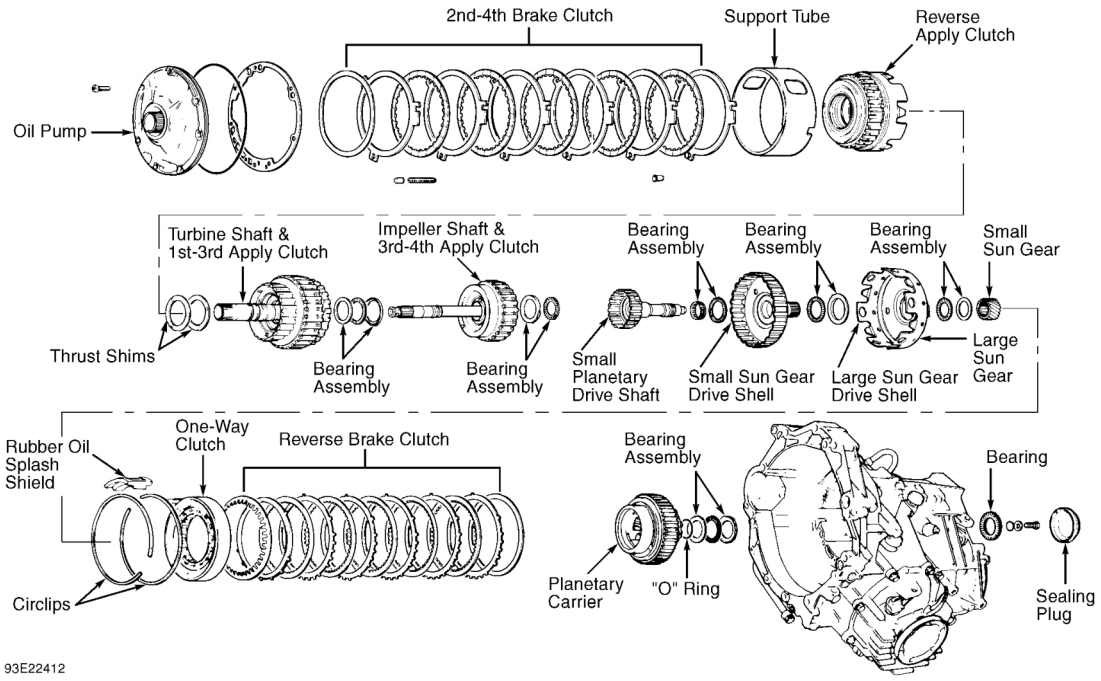

Fig. 19: Exploded View Of A/T Components (097 Shown; 098 Is Similar)
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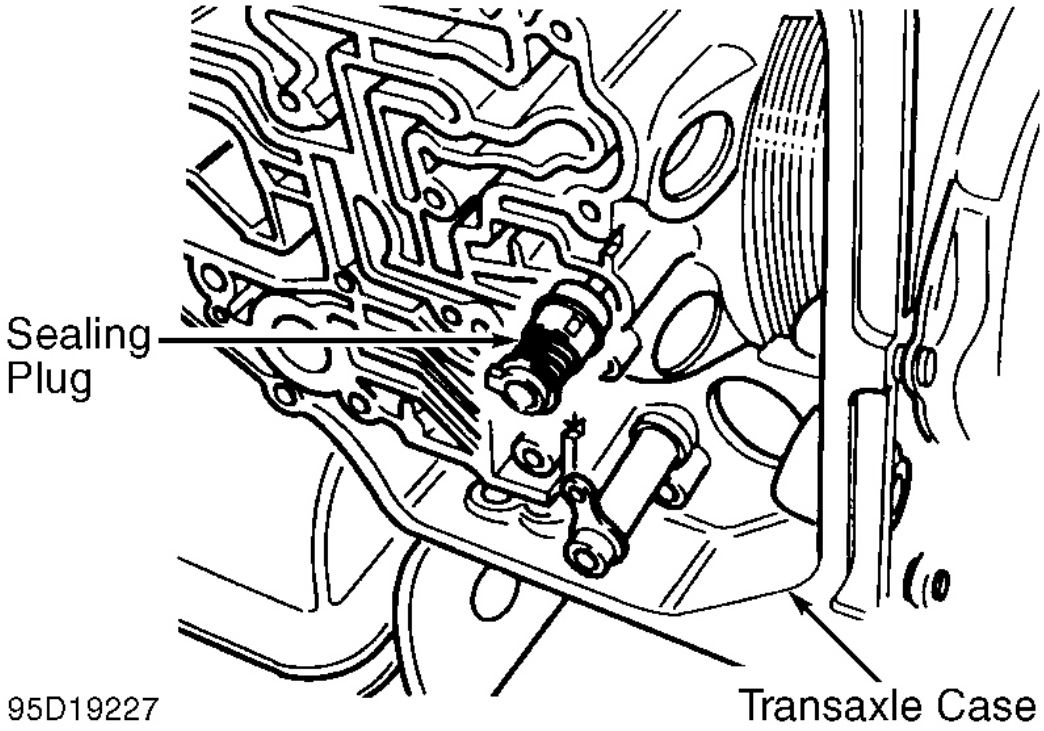

Fig. 20: Locating Sealing Plug
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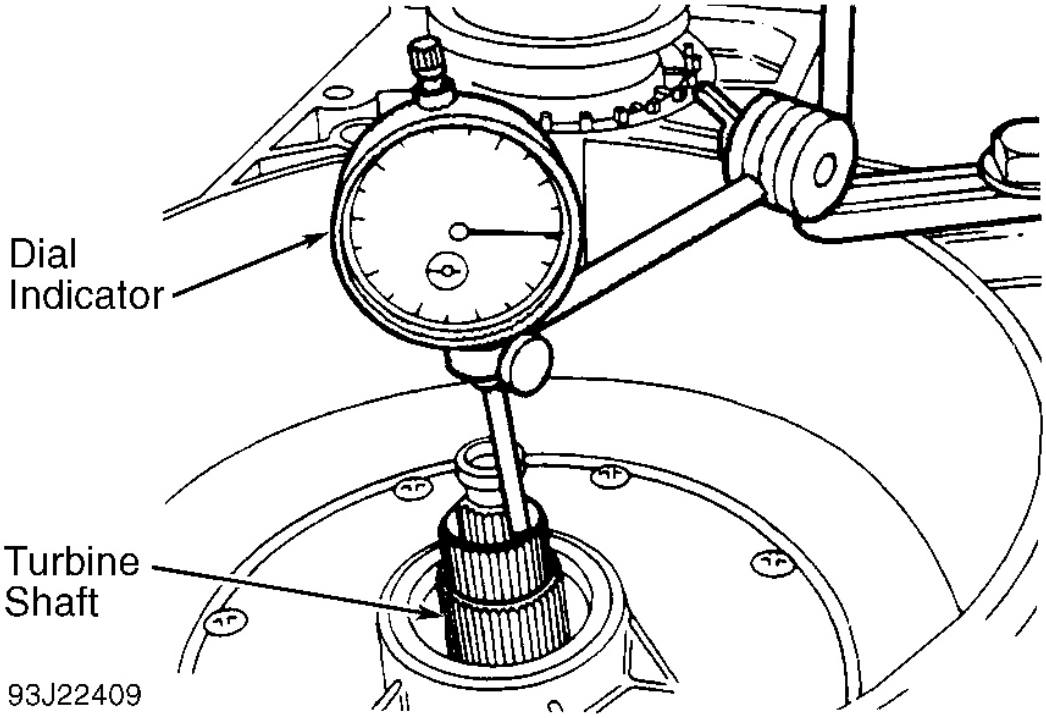

Fig. 21: Checking Turbine Shaft End Play
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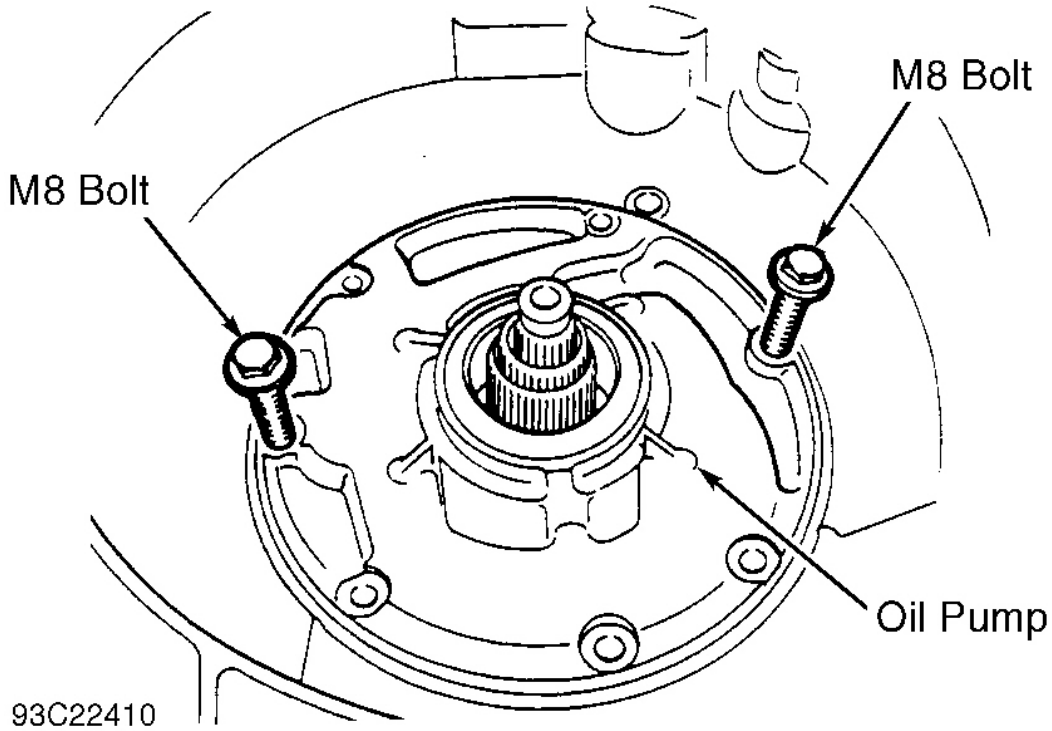

Fig. 22: Removing Oil Pump
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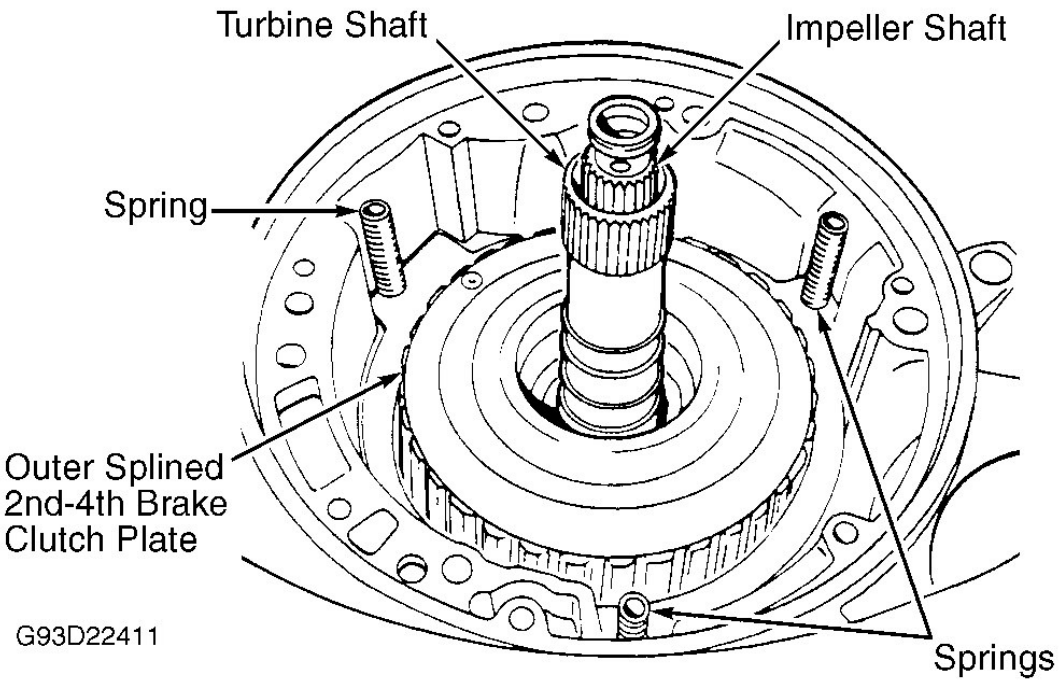

Fig. 23: Removing Turbine Shaft W/2nd-4th Brake Clutch & 1st-3rd Apply Clutch
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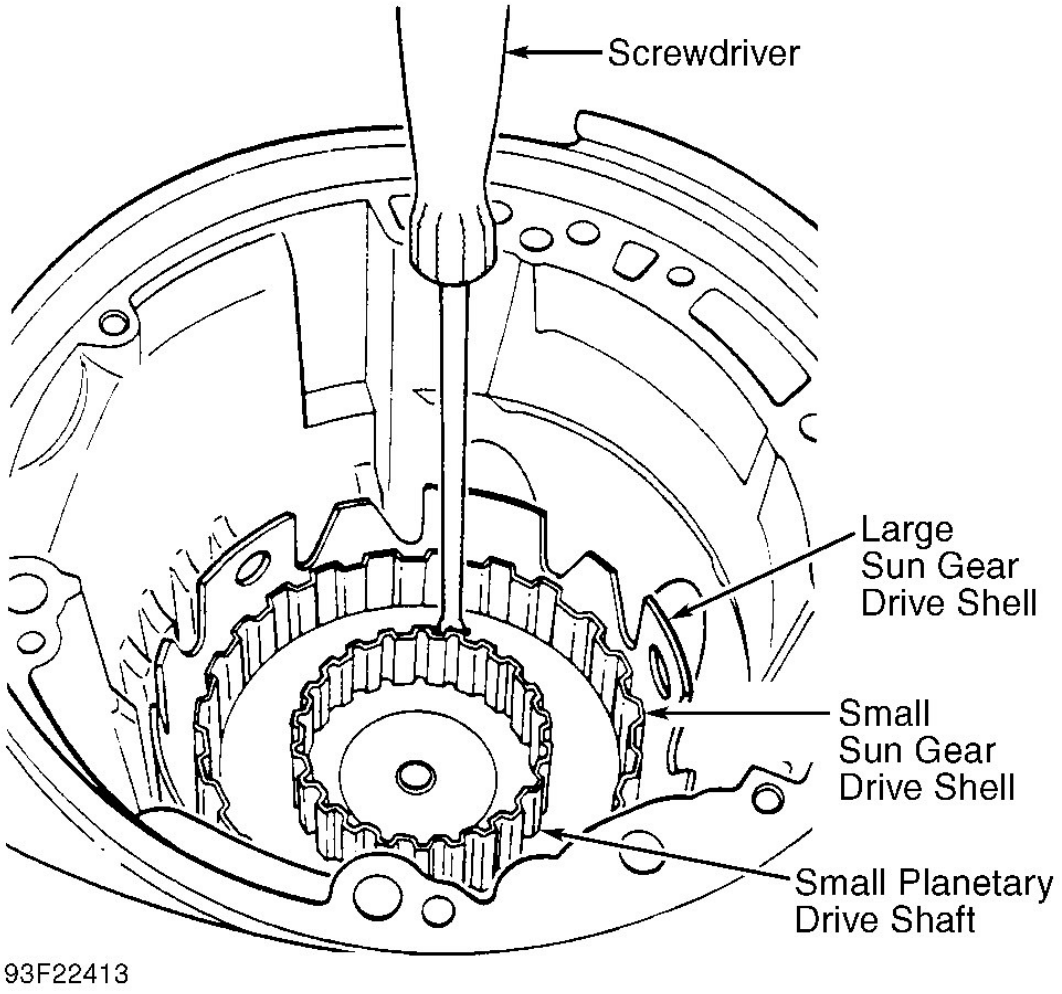

Fig. 24: Locking Small Sun Gear Drive Shell
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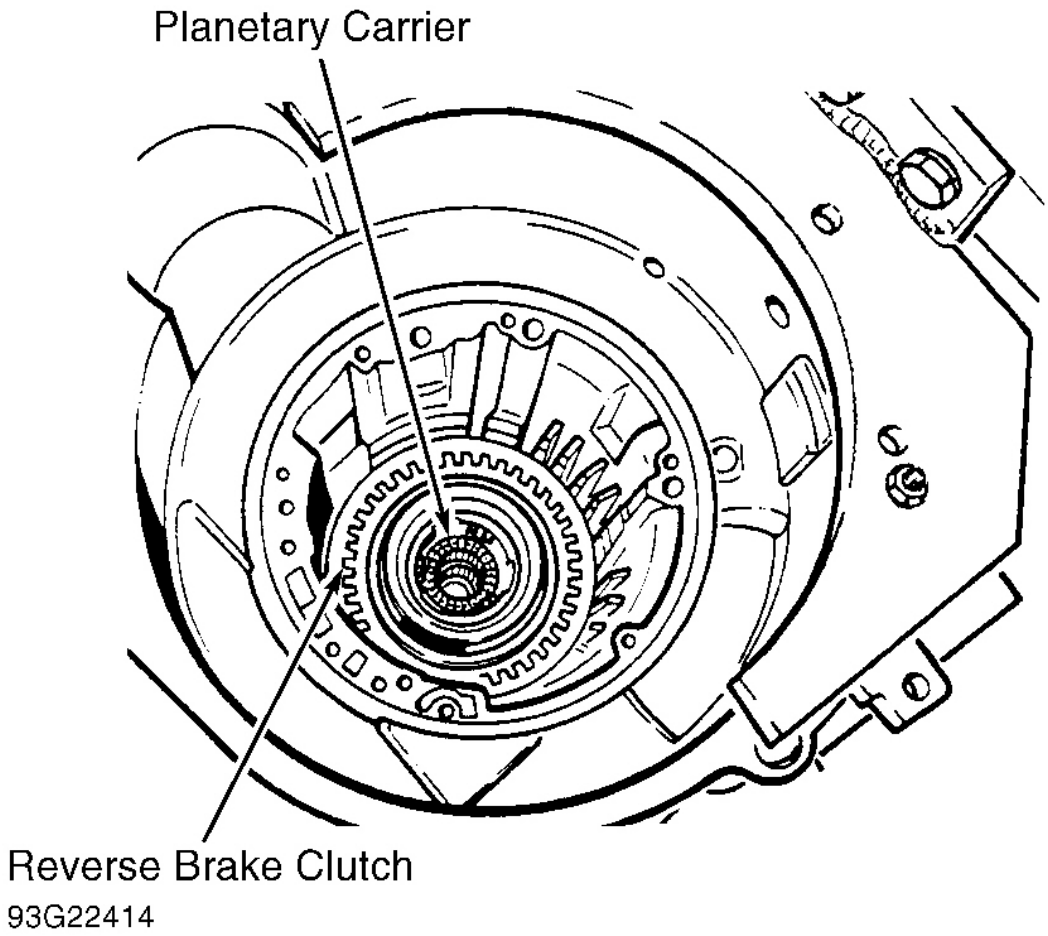

Fig. 25: Removing Planetary Carrier & Reverse Brake Clutch
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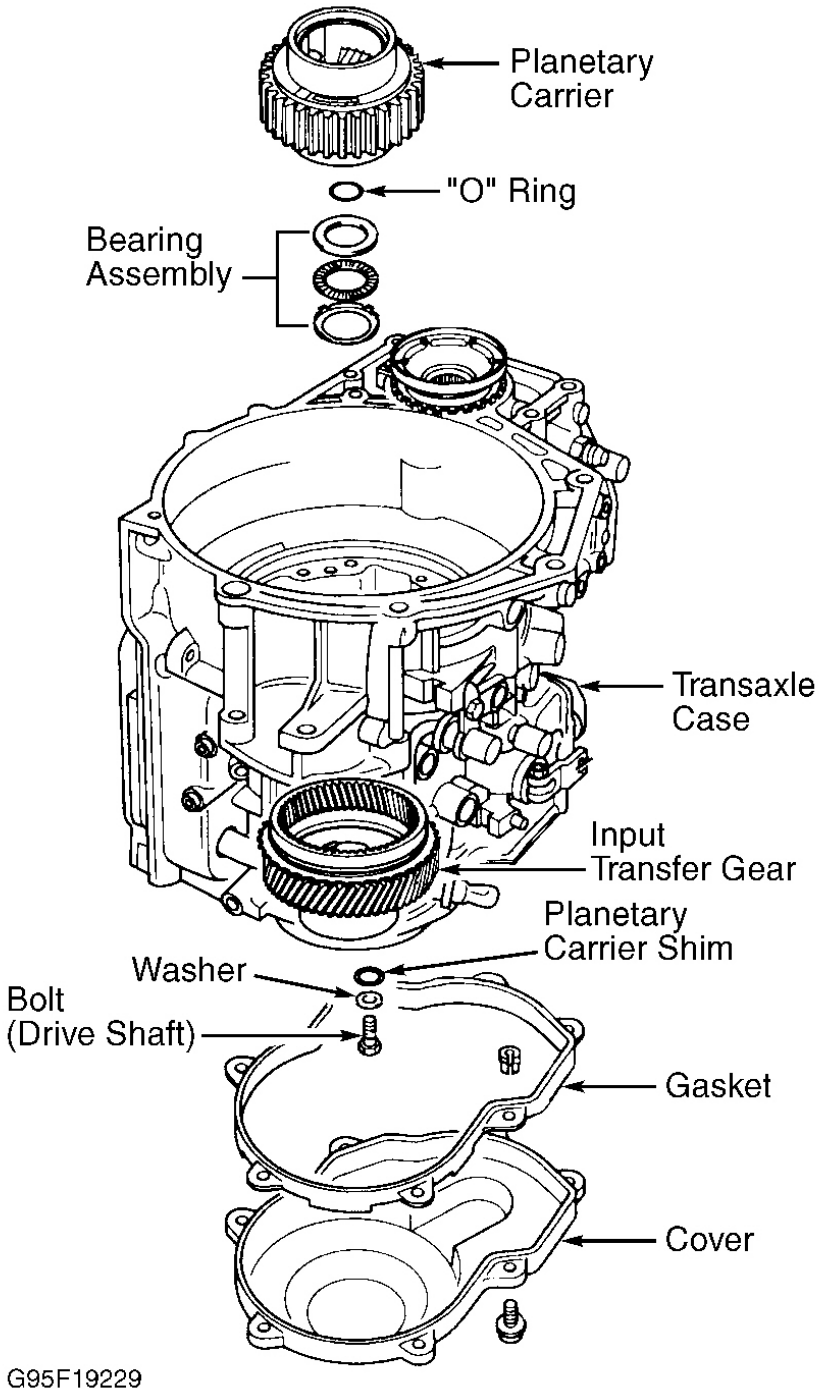

Fig. 26: Locating Planetary & Input Gear Assembly
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FINAL DRIVE & TRANSFER GEARS

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1. Drain gear oil. Attach INCH-lb. torque wrench to a 1 5/8" (41 mm) socket wrench. Measure and record total roller bearing turning torque of drive pinion gear. This measurement is required if roller bearings are reused.
2. Using a screwdriver, pry out drive flange cap. Using a slide hammer, remove axle shaft and drive flange assembly. Remove circlip retaining axle shaft drive flange. Using press, remove drive flange from axle shaft.
3. Using a screwdriver, remove oil seal and circlip from bearing housing. See **Fig. 27** . Using a puller, remove axle shaft needle bearing. Remove bearing housing and "O" ring. Remove torque converter housing.
4. Thread a slide hammer into axle flange bolt hole and pull axle flange assembly. Remove axle flange seal from transaxle case. Remove differential assembly from transaxle case. See **Fig. 28** .
5. Turn transaxle case over. Engage parking pawl. Using a 7/8" (22 mm) Allen wrench socket, remove fastener nut. See **Fig. 29** . Remove dished washer, bearing and shim.
6. Remove roller bearing from input gear snout. From other side, remove input gear assembly, containing other roller bearing and needle bearing inside snout.
7. Using INCH-lb. torque wrench, measure turning force of drive pinion and transfer gear bearings. Record measurement for reassembly. Engage parking pawl. Remove nut from pinion. See **Fig. 30** .
8. Using puller, remove output gear. See **Fig. 31** . Using Puller (VAG 1582) and Adapter (VAG 1582/4), remove roller bearing. See **Fig. 32** . Remove selector shaft and parking pawl assembly.
9. Remove bearing support retaining bolts and bearing support retainer. Remove shim and parking lock gear from drive pinion. Remove bearing support ring bolt from outside case. Using pin socket, remove inner bearing support ring with drive pinion "O" ring seal and gasket.

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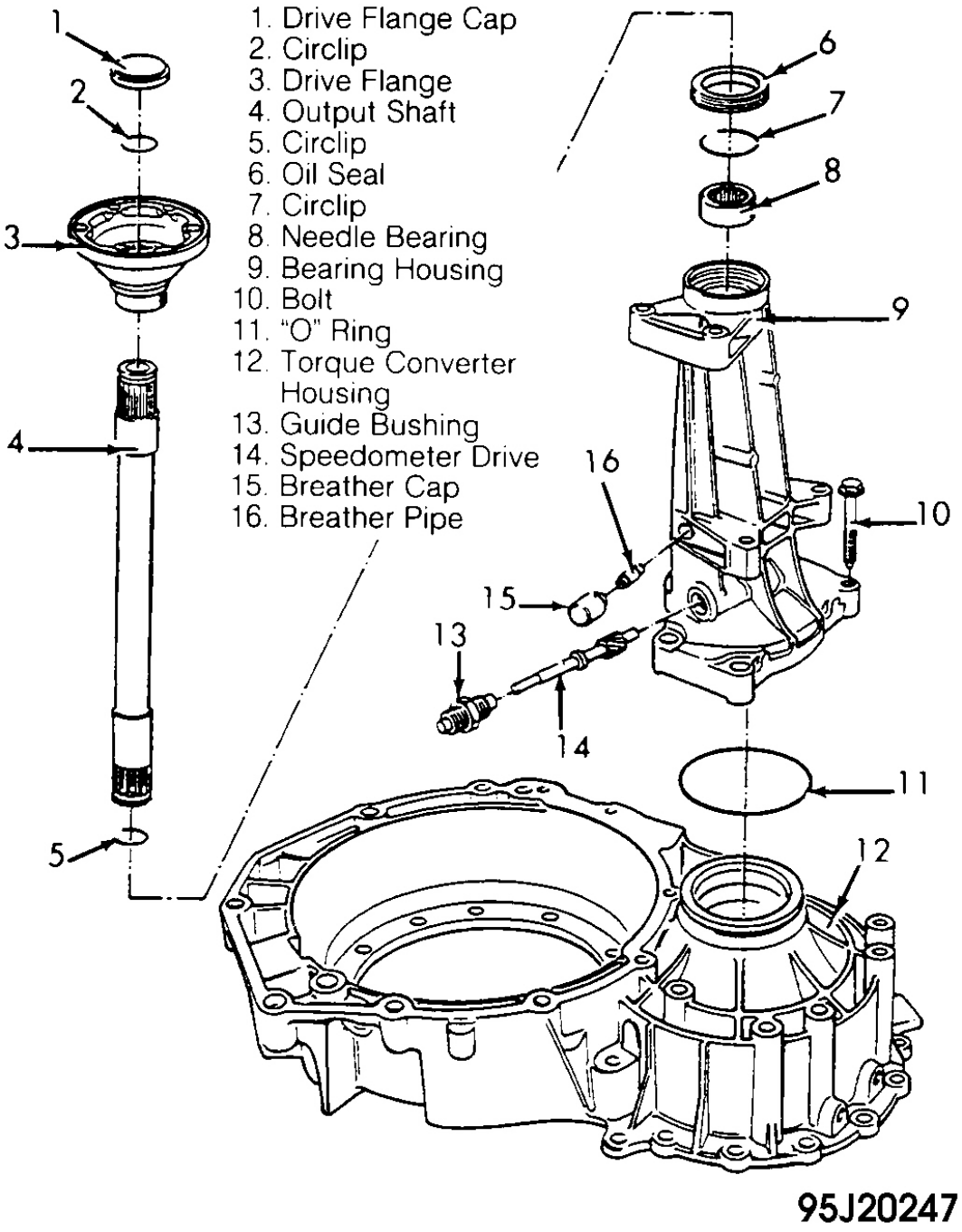

Fig. 27: Exploded View Of Bearing Housing & Axle Shaft Assembly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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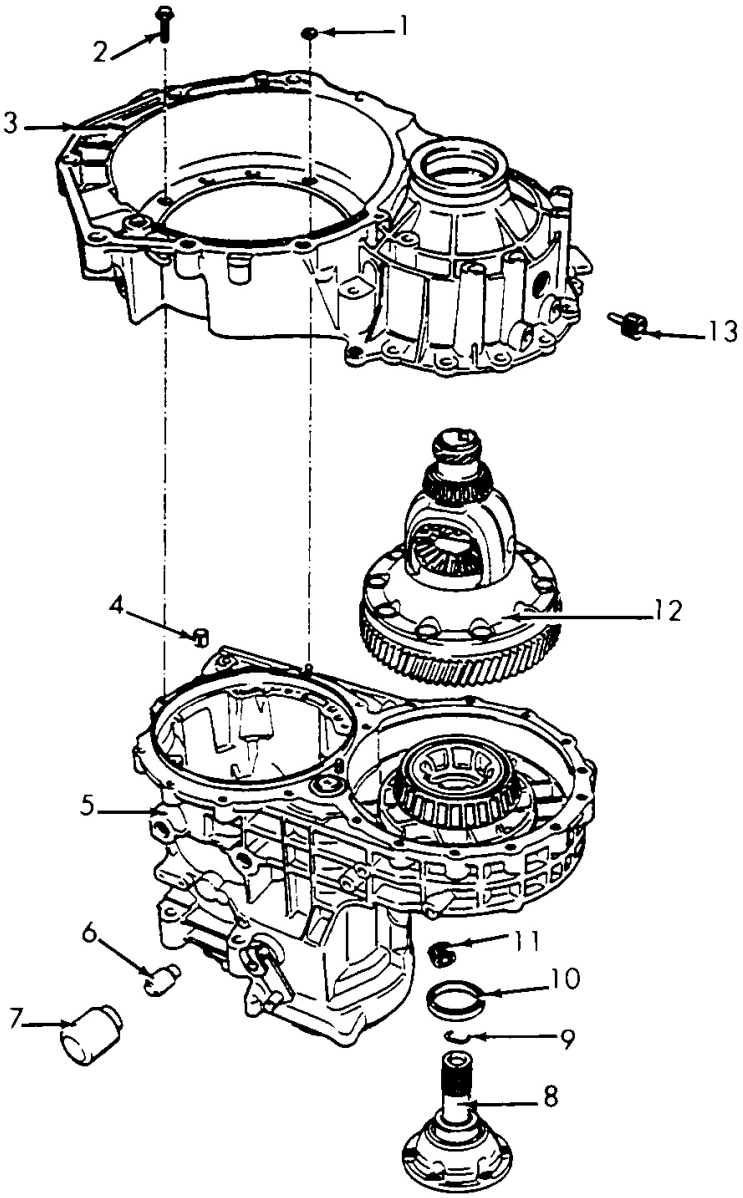

1. Nut
2. Bolt
3. Torque Converter Housing
4. Alignment Sleeve
5. Transaxle Case
6. Breather Pipe
7. Breather Cap
8. Axle Shaft & Drive Flange Assembly
9. Circlip
10. Oil Seal
11. Screw
12. Differential Assembly
13. Screw

Fig. 28: Removing Differential Assembly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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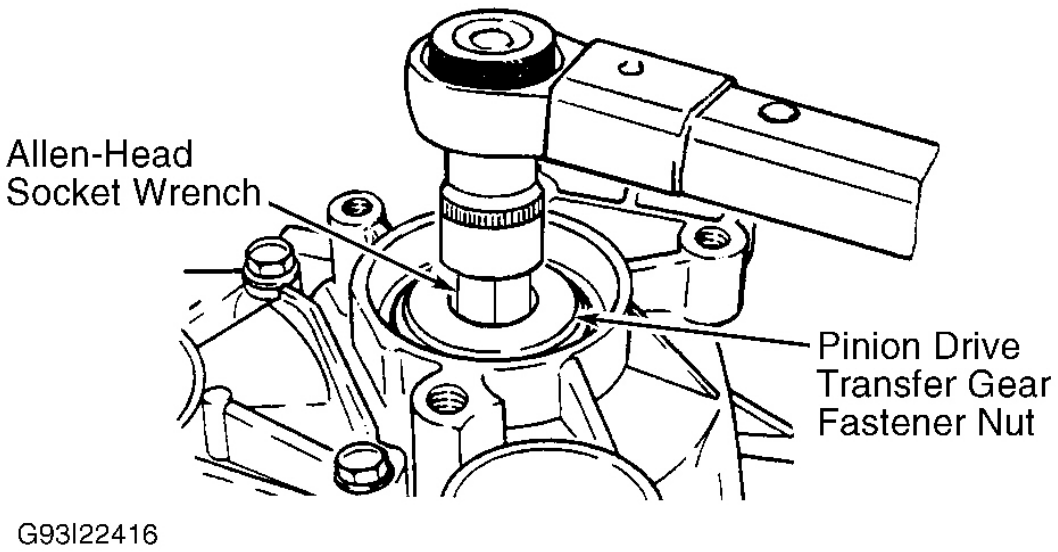

Fig. 29: Removing Input Transfer Gear Fastener Nut (097 Is Shown; 098 Is Similar)
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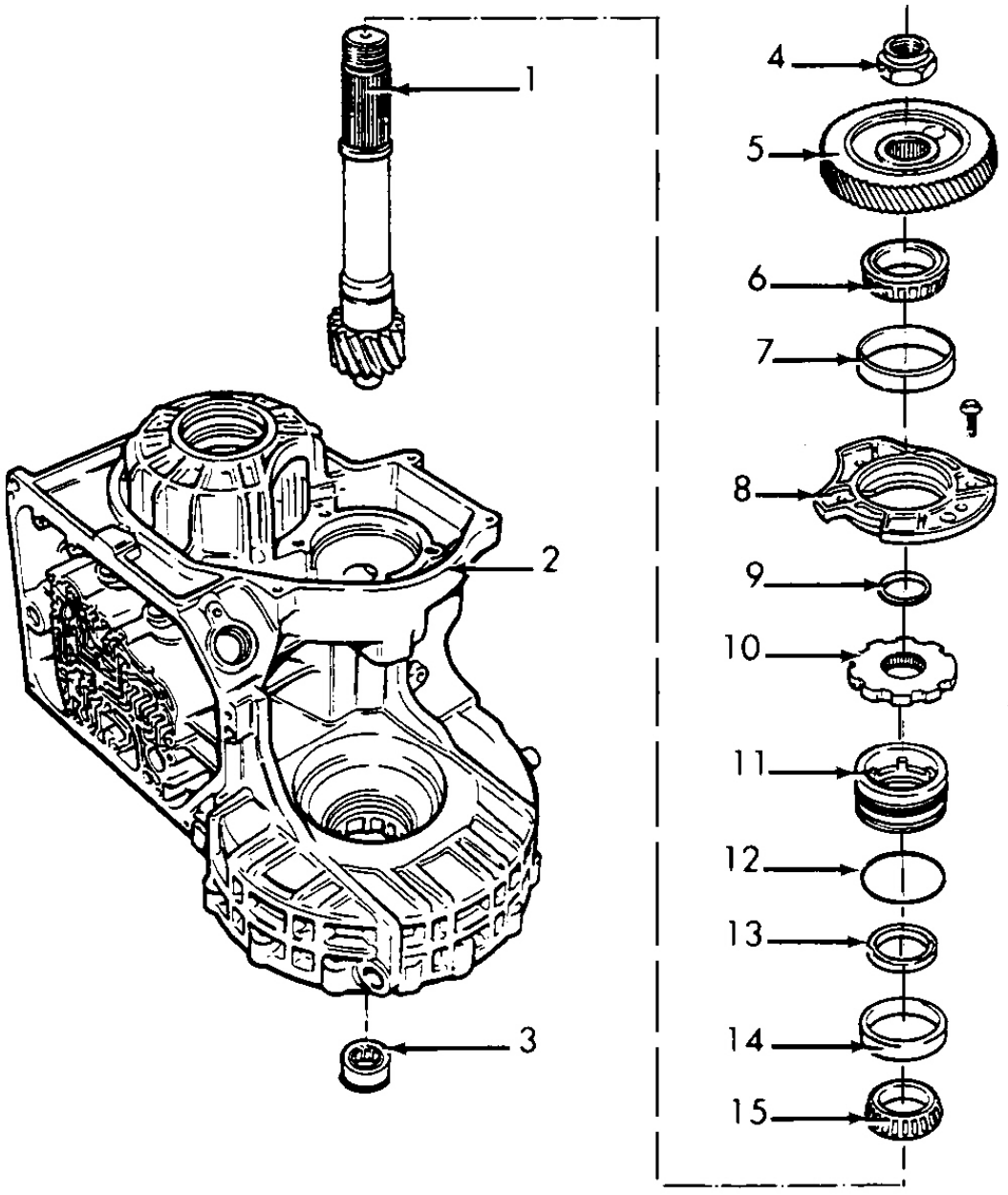

1. Drive Pinion
2. Transaxle Case
3. Needle Bearing
4. Nut
5. Output Gear
6. Bearing
7. Race
8. Bearing Support
9. Shim
10. Parking Lock Gear
11. Bearing Support Ring
12. "O" Ring
13. Seal
14. Race
15. Bearing

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Fig. 30: Exploded View Of Drive Pinion & Output Gear Assembly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

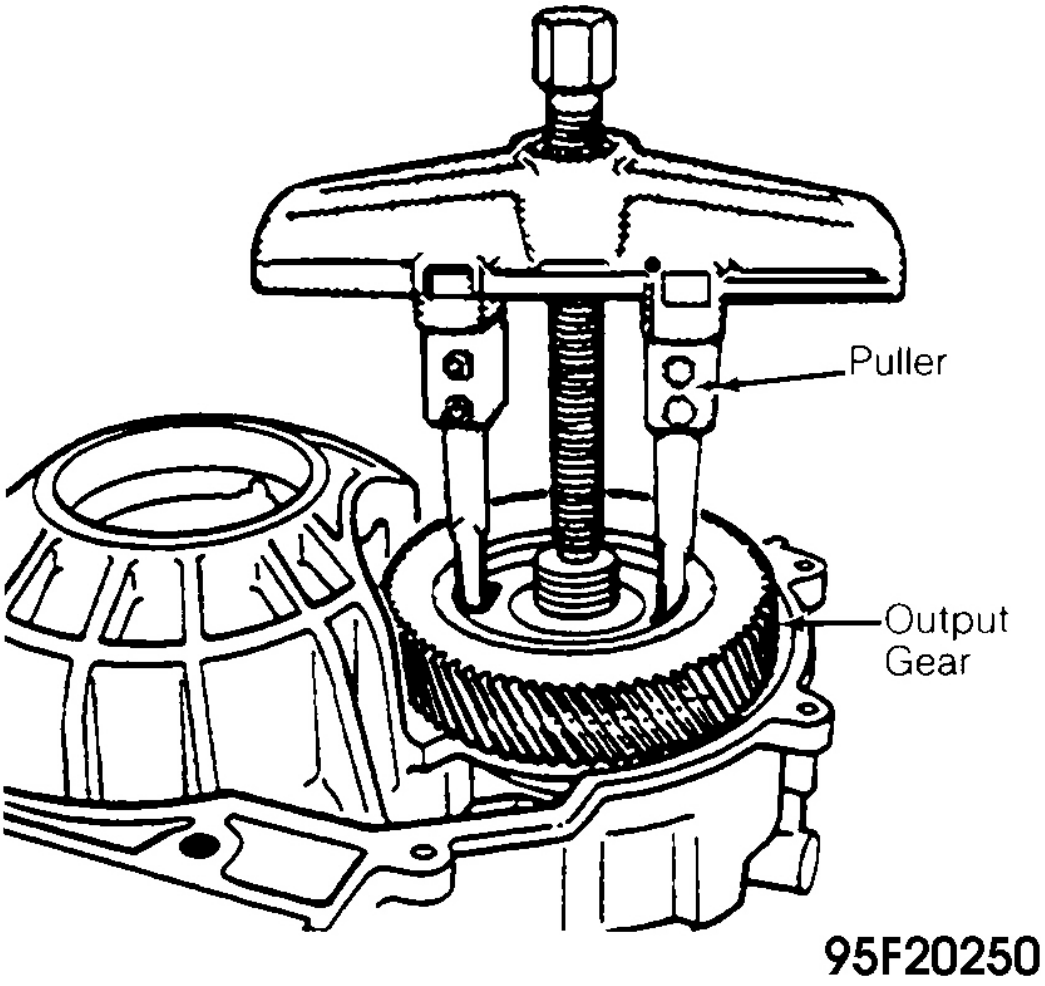

Fig. 31: Removing Output Gear
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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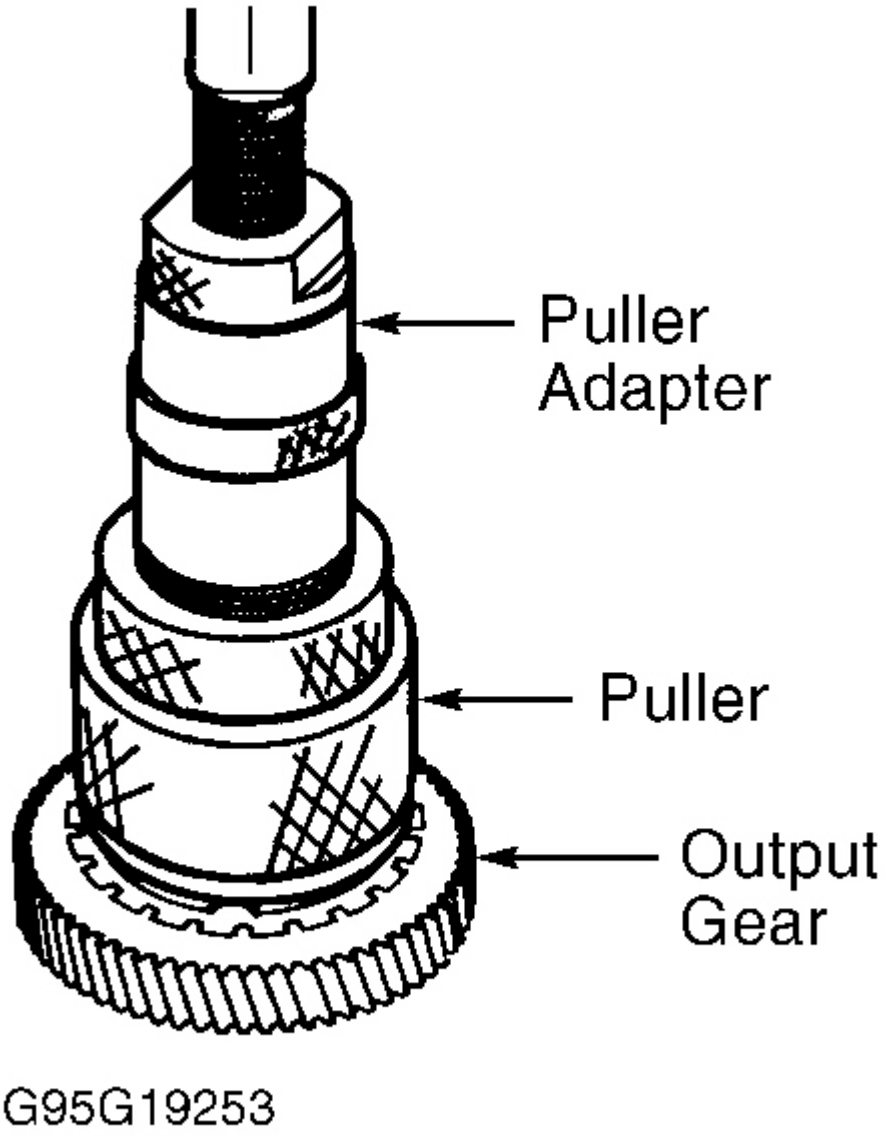

Fig. 32: Removing Output Gear Roller Bearing
Courtesy of VOLKSWAGEN UNITED STATES, INC.

COMPONENT DISASSEMBLY & REASSEMBLY

FINAL DRIVE

1. Disassemble differential. See **Fig. 33** . If ring gear or differential housing is damaged, replace differential

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housing. To reassemble differential, reverse disassembly.

NOTE: If differential bearings are replaced, check differential side bearing preload and ring gear position. See FINAL DRIVE & TRANSFER GEARS under TRANSAXLE REASSEMBLY.

2. Remove speedometer drive gear circlip and speedometer drive gear. Remove roller bearing from differential housing.
3. Check all bearing races in adjuster rings and replace if necessary. Using hydraulic press, replace bearing race(s). Replace each roller bearing and race as a set.
4. Using a chisel, drive out pinion pin roll pin. Using a drift punch, drive out pinion pin. Rotate differential gears out of differential housing.

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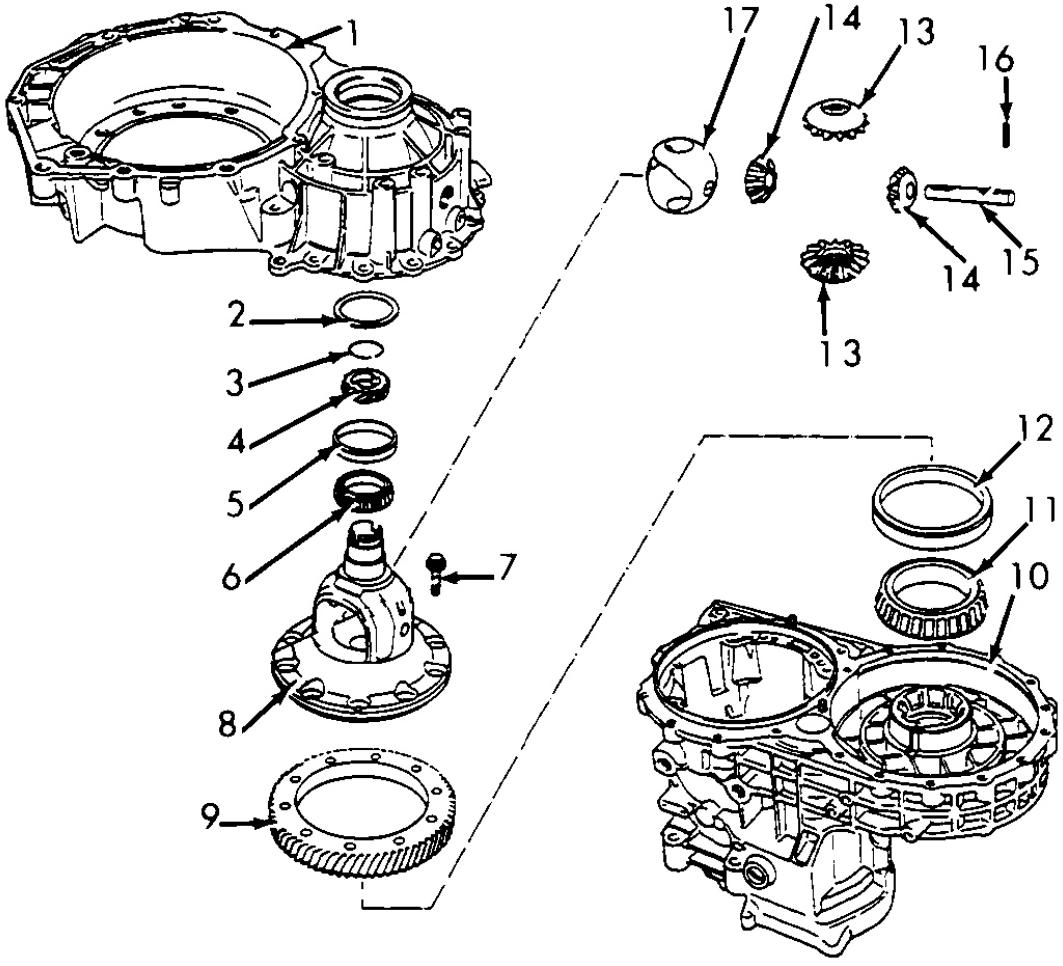

1. Torque Converter Housing
2. Shim
3. Circlip
4. Speedometer Drive Gear
5. Roller Bearing Race
6. Roller Bearing
7. Bolt
8. Differential Housing
9. Final Drive Gear
10. Transaxle Case
11. Roller Bearing
12. Roller Bearing Race
13. Large Bevel Gears
14. Small Bevel Gears
15. Bevel Gear Shaft
16. Roll Pin
17. Thrust Washer

Fig. 33: Exploded View Of Differential Assembly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

OIL PUMP & 2ND-4TH BRAKE CLUTCH PISTON

Disassemble oil pump and 2nd-4th brake clutch piston. Check for worn or damaged parts and replace as

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necessary. Replace all seals and reassemble. See **Fig. 34** .

NOTE: Specifications are not available from manufacturer.

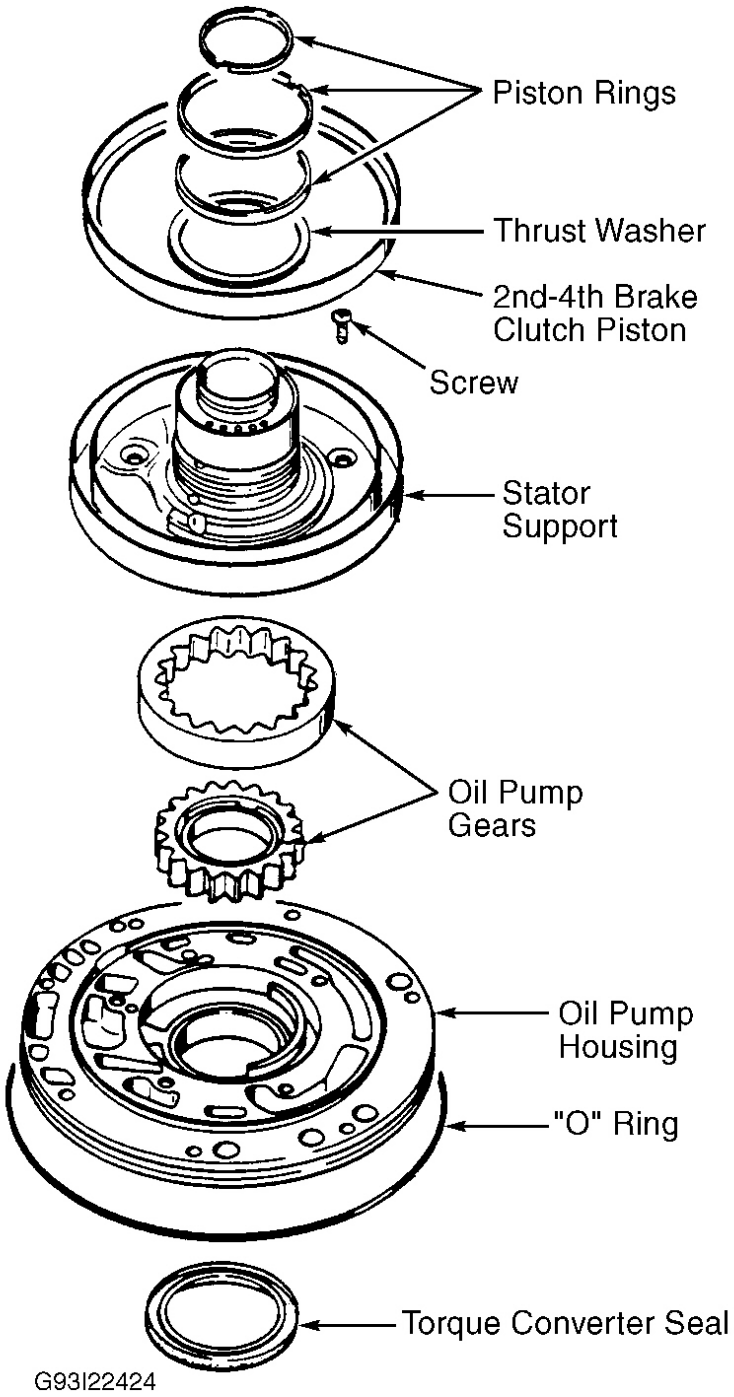

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Fig. 34: Exploded View Of Oil Pump & 2nd-4th Brake Clutch Piston
Courtesy of AUDI OF AMERICA, INC.

ONE-WAY CLUTCH

1. Disassemble one-way clutch. Check for worn or damaged parts and replace as necessary. Compress each spring and install into cage. See **Fig. 35** .
2. Hold cage assembly with large lugs up. Install the cage assembly into outer ring. See **Fig. 36** . Turn the cage clockwise until lugs touch stop. See **Fig. 37** . Install the piston into the outer ring. See **Fig. 38** .

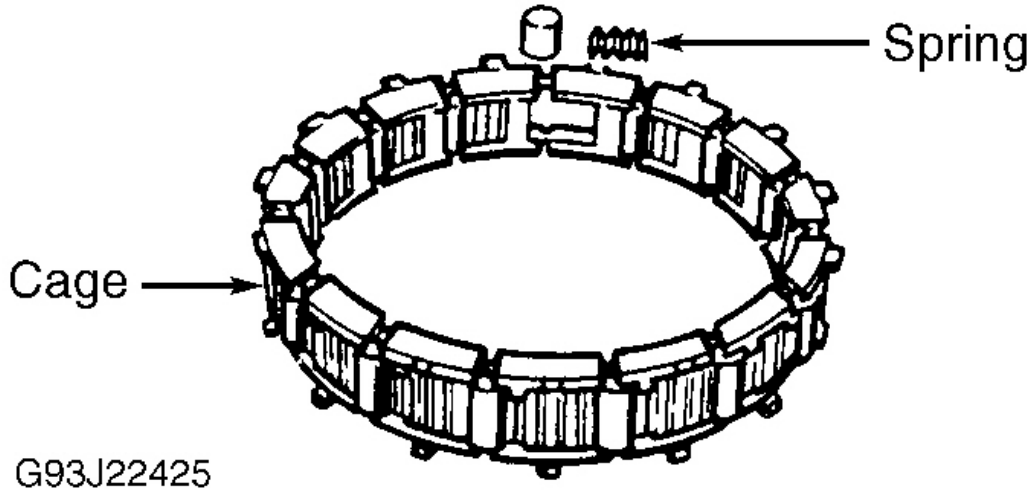

Fig. 35: Installing Springs Into Cage
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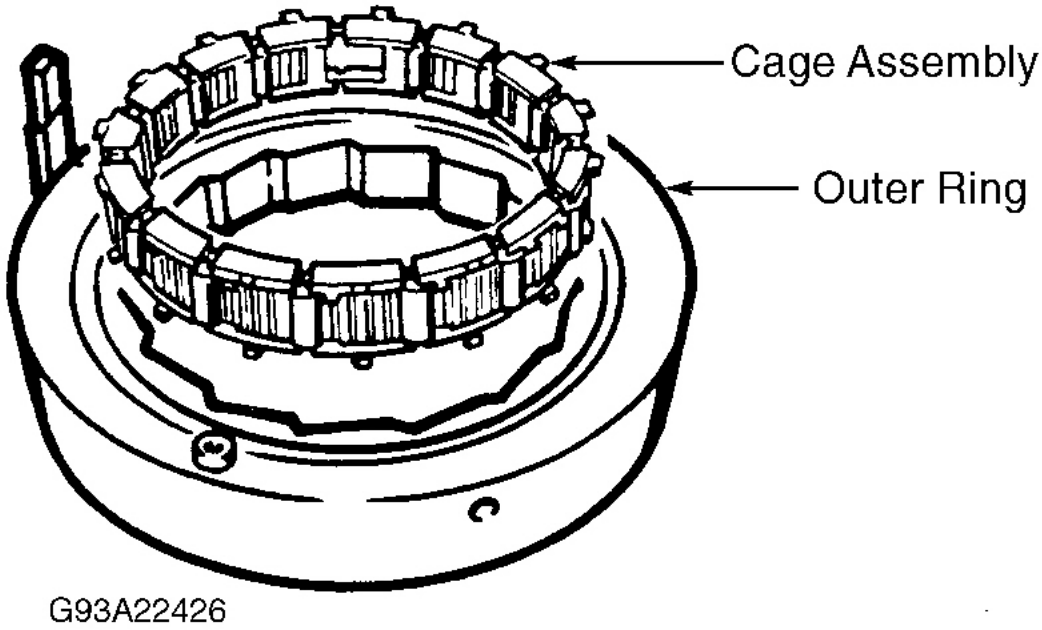

Fig. 36: Installing Cage Assembly Into Outer Ring
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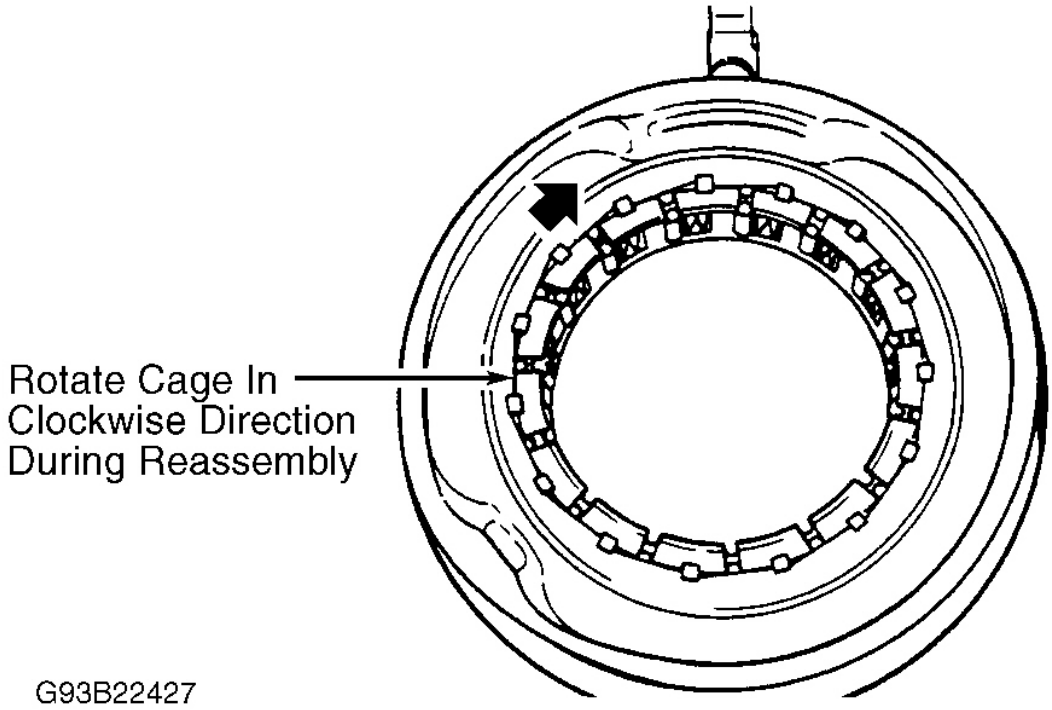

Fig. 37: Rotate Cage Clockwise Until Stop
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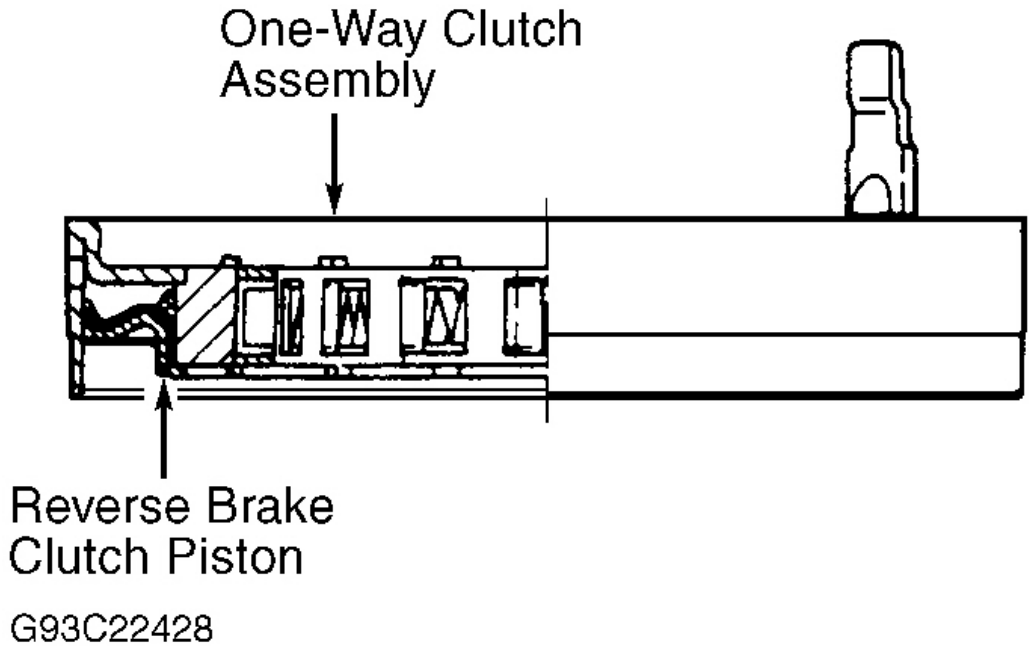

Fig. 38: Installing Piston Into One-Way Clutch
Courtesy of AUDI OF AMERICA, INC.

PLANETARY CARRIER

NOTE: Disassembly and reassembly procedures are not available from manufacturer.

Inspection & Adjustment

1. Inspect planetary carrier, pinion gears, sun gears and related parts for wear or damage. Replace parts as necessary.
2. Assemble sun gear drive shells, planetary carrier, small sun gear, pinion drive transfer gear and all related bearings and washers onto small planetary drive shaft. See **Fig. 39** .
3. Place assembly into transaxle case. Install adjustment shim, washer and bolt to pinion drive transfer gear end of small planetary drive shaft. Using a screwdriver, lock small sun gear drive shell to large sun gear drive shell. See **Fig. 24** . Tighten bolt to 22 ft. lbs. (30 N.m).
4. Place Dial Indicator Support (VW 382/7) on top of assembly. See **Fig. 40** . Measure end play of small sun gear drive shaft.
5. If end play is not .009-.014" (.23-.37 mm), replace adjustment shim. Adjustment shims range from .040" (1.00 mm) to .114" (2.90 mm) in .004" (.10 mm) increments.

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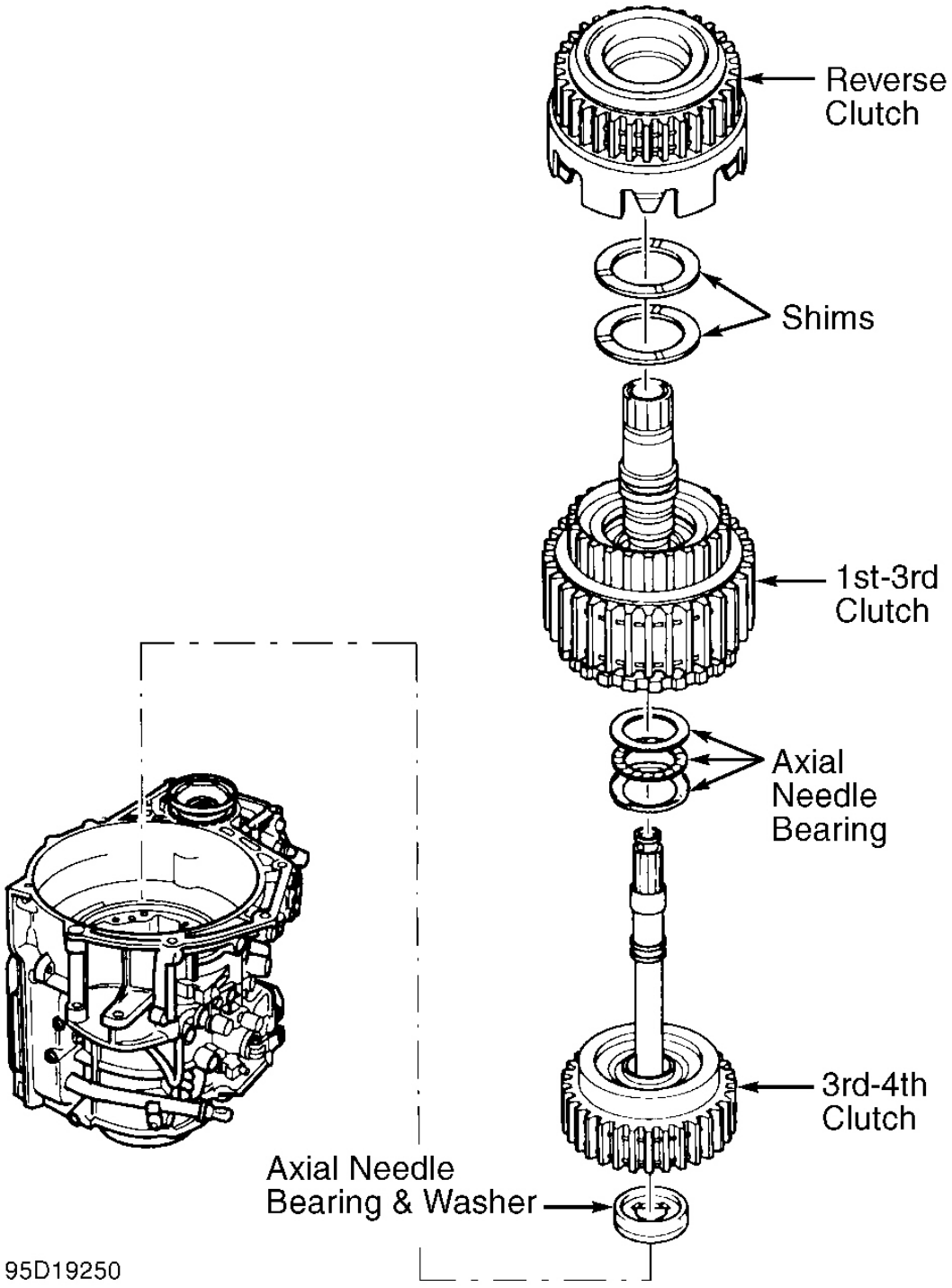

Fig. 39: Locating Planetary Carrier Elements
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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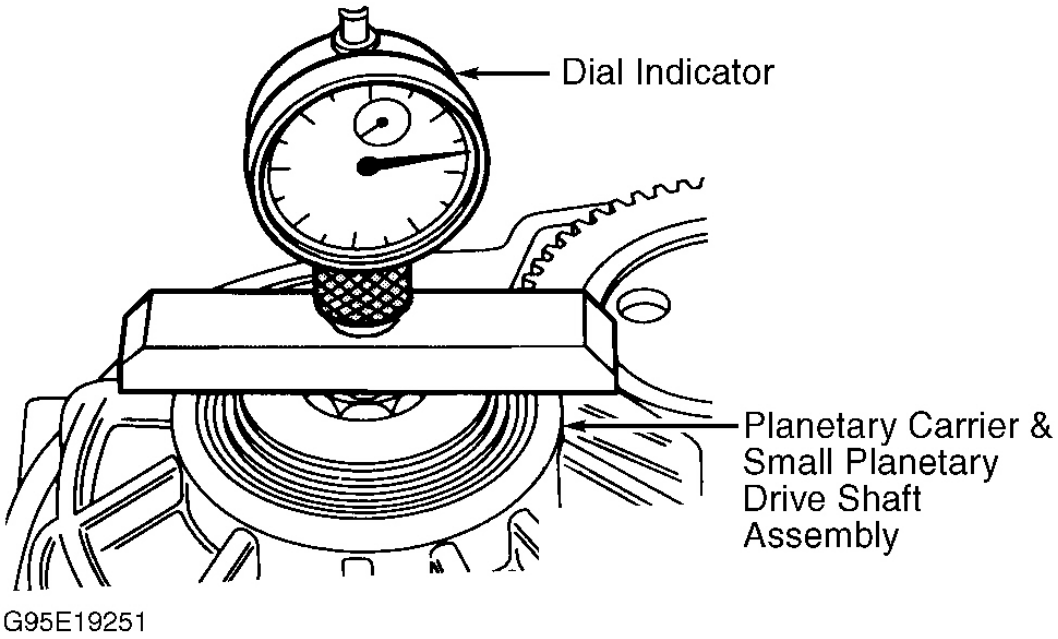

Fig. 40: Adjusting Planetary Carrier End Play
Courtesy of VOLKSWAGEN UNITED STATES, INC.

CLUTCH PLATE APPLICATIONS

CLUTCH PLATE APPLICATIONS

Application	Number Of Plates
Reverse Clutch	
Inner	5
Outer	5
1st-3rd Clutch	
Inner	5
Outer	4
3rd-4th Clutch	
Inner	5
Outer	4

REVERSE APPLY CLUTCH

NOTE: Soak all friction-faced clutch plates in ATF for at least 15 minutes before installation.

1. Mark circlip for installation reference and remove. Disassemble clutch plates. See **Fig. 41** . Compress

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spring support, and remove circlip. Remove clutch piston.

2. Check for worn or damaged parts and replace as necessary. Ensure check ball in clutch housing is not damaged. Piston seal is part of piston. If damaged, replace reverse apply clutch piston. Reassemble reverse apply clutch. See **CLUTCH PLATE APPLICATIONS** .

NOTE: Assembled clutch clearance specification is not available from manufacturer. Ensure thrust plate is installed with shouldered side facing circlip.

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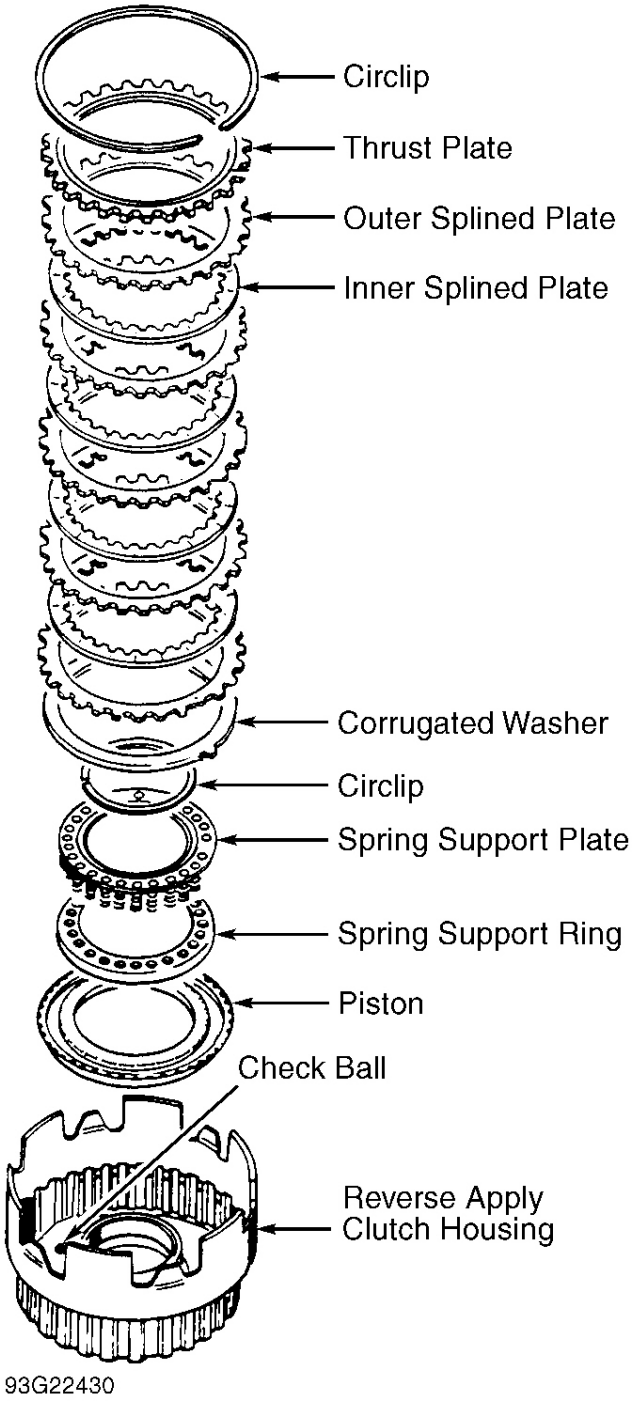

Fig. 41: Exploded View Of Reverse Apply Clutch
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REVERSE & 2ND-4TH BRAKE CLUTCHES

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The reverse and 2nd-4th brake clutches are disassembled and reassembled during transaxle disassembly and reassembly. Refer to disassembly procedures under **TRANSAXLE DISASSEMBLY** and reassembly procedures under **TRANSAXLE REASSEMBLY** .

TRANSAXLE CASE

1. Remove multifunction switch, all seals, manual valve assembly, parking pawl and sensors. If necessary, remove parking pawl pin, detent spring screws and selector rod for manual valve from case. See **Fig. 42** . Pry out bushings and bearing races, and replace if necessary.
2. Install NEW "O" ring to gear change shaft. Install gear change shaft. Install parking pawl pin (if removed). Using a center punch, peen parking pawl pin. Install operating rod for manual valve, detent spring screws, multifunction switch and NEW seals. See **Fig. 42** .

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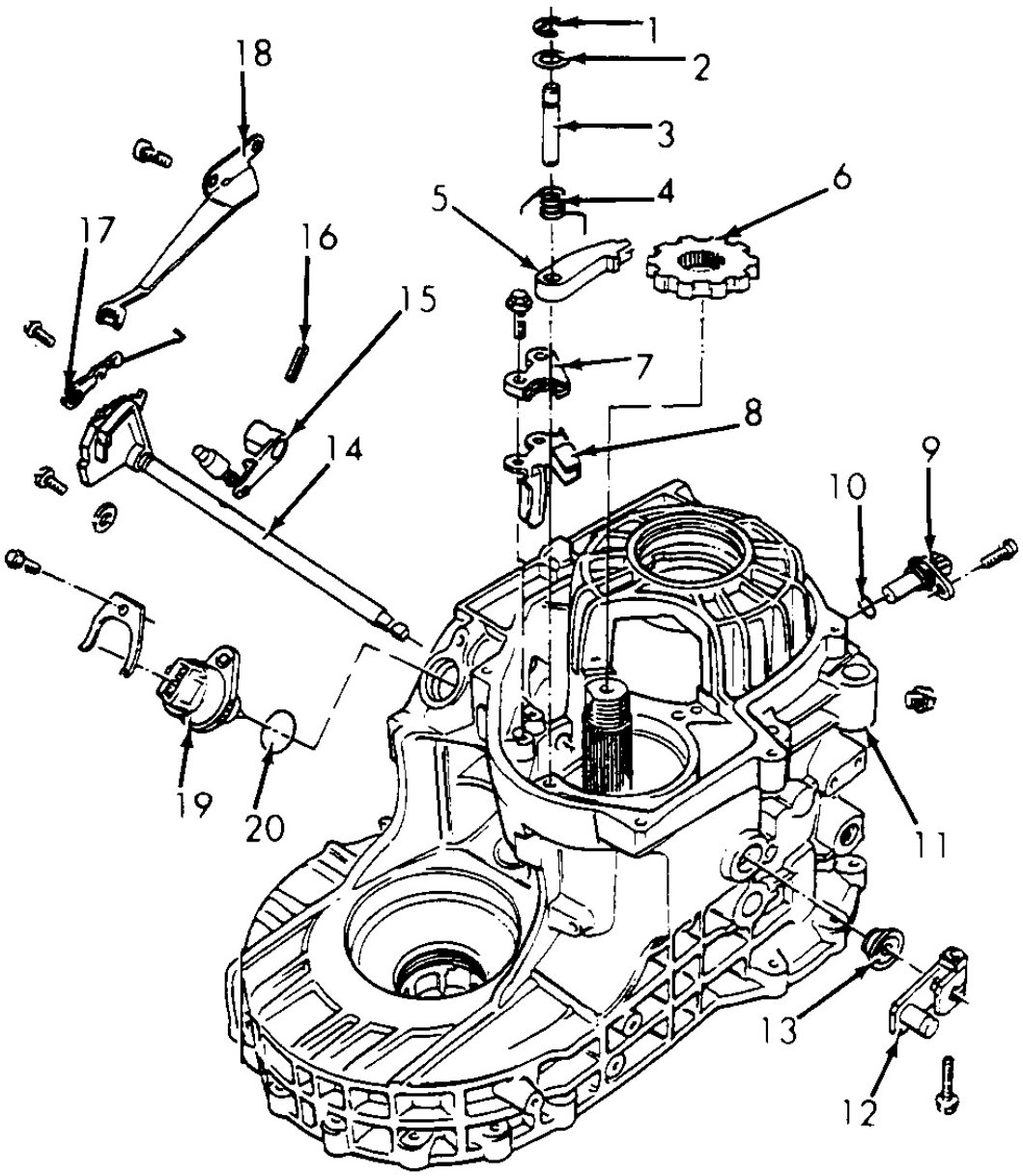

1. Circlip
2. Washer
3. Parking Pawl Pin
4. Return Spring
5. Parking Pawl
6. Parking Lock Gear
7. Support Plate
8. Guide Plate
9. Speed Sensor
10. "O" Ring
11. Transaxle Case
12. Gear Change Shaft Lever
13. Seal
14. Gear Change Shaft W/Shift & Detent Segment
15. Operating Lever
16. Roll Pin
17. Manual Valve Control
18. Shift Segment Spring
19. Multifunction Switch
20. "O" Ring

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Fig. 42: Exploded View Of Transaxle Case Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

TRANSFER GEARS

Using puller and adapter, remove tapered roller bearing from output gear. See **Fig. 32** . Using hydraulic press, install bearing to drive pinion transfer gear. Set transfer and drive pinion gears aside.

VALVE BODY

NOTE: Disassembly and reassembly procedures are not available from manufacturer.

1ST & 3RD APPLY CLUTCH

1. Remove support ring. Mark circlip for installation reference, and remove circlip. Disassemble clutch plates. See **Fig. 43** . Remove diaphragm spring circlip. Compress spring support, and remove circlip. See **Fig. 44** . Remove spring plates and clutch piston.
2. Remove piston rings from piston. Piston seal is part of piston. If damaged, replace 1st-3rd apply clutch piston. Remove seal rings from turbine shaft. Check for worn or damaged parts and replace as necessary. Ensure check ball in clutch housing is not damaged.

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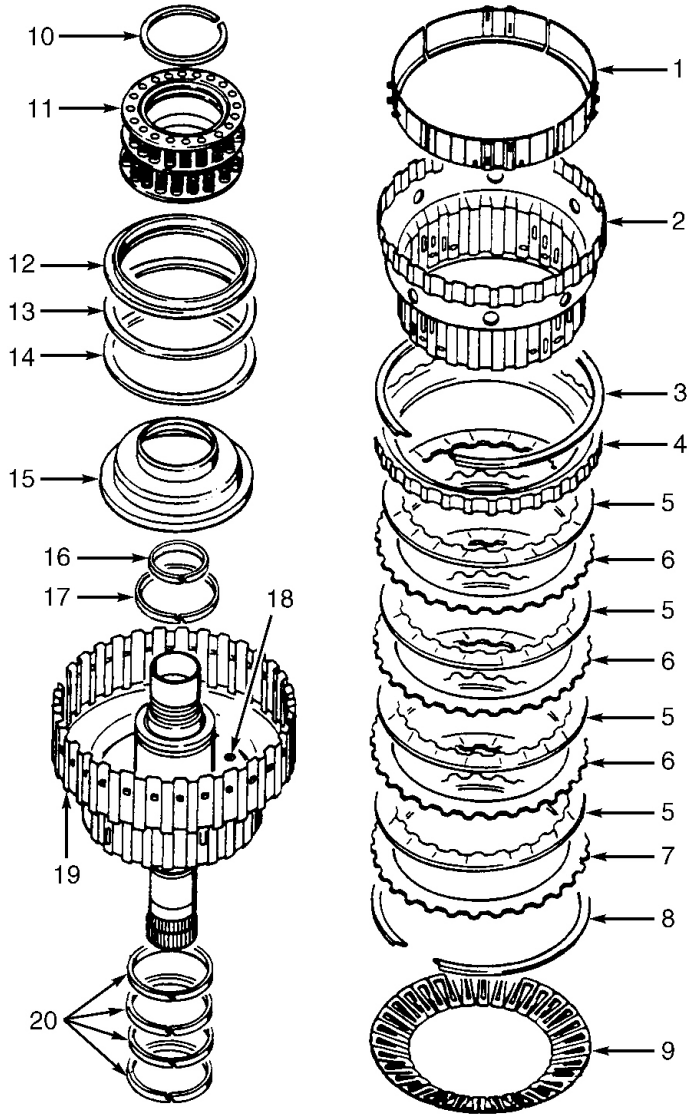

1. Support Ring
2. Inner Splined Plate Carrier
3. Circlip
4. Thrust Plate
5. Inner Splined Plate
6. Outer Splined Plate
7. Thrust Plate
8. Circlip
9. Diaphragm Spring
10. Circlip
11. Intermediate Spring Assembly
12. Operating Spring
13. Plate Spring
14. Plate Spring
15. Piston
16. Piston Ring
17. Piston Ring
18. Check Ball
19. 1st-3rd Apply Clutch Housing
20. Piston Rings

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Fig. 43: Exploded View Of 1st-3rd Apply Clutch (Early 1993 Shown; Late 1993-94 Is Similar)
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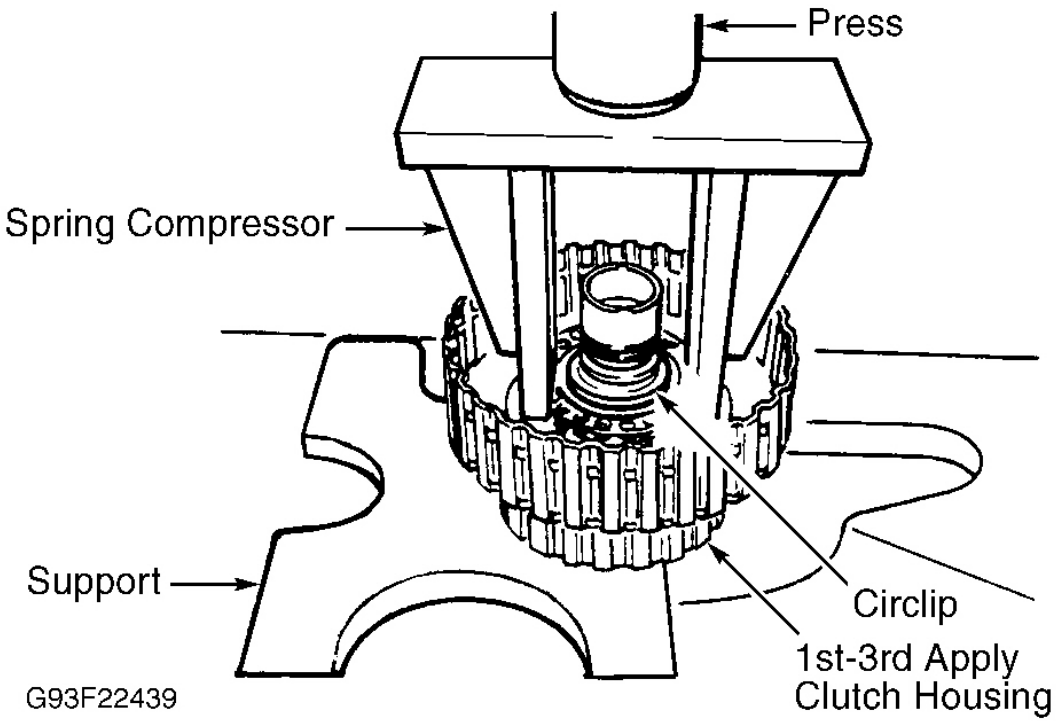

Fig. 44: Removing & Installing Spring Circlip
Courtesy of VOLKSWAGEN UNITED STATES, INC.

3. Install NEW seal rings to clutch piston, and install piston in clutch housing. Install plate springs with curved sides facing piston. Install operating ring with curved side facing springs. Compress spring support and install circlip. See **Fig. 43** .
4. On early 1993, install diaphragm spring with curved side facing piston. Install circlip. See **Fig. 45** . On all model years, install bottom thrust plate with smooth side facing clutch plate. Install one inner splined and one outer splined clutch plate into clutch housing. See **Fig. 44** .
5. Place inner plate carrier on bench. Install remaining clutch plates to inner plate carrier. See **CLUTCH PLATE APPLICATIONS** . Insert top thrust plate with smooth side facing clutch plate. On early 1993, install support ring and snap it in place. See **Fig. 46** . On late 1993 and 1994 models, install the support ring with the step tabs facing up after installing thrust plate, friction plates and steel plates.
6. On all model years, Install inner plate carrier into clutch housing. Install circlip in clutch housing. See **Fig. 47** .

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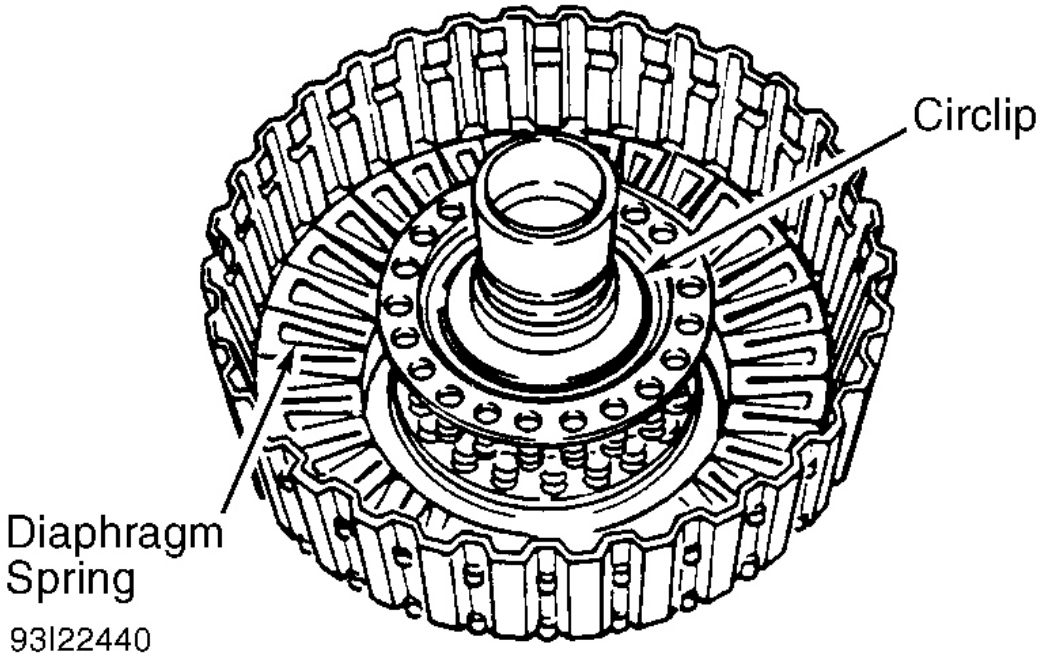

Fig. 45: Installing Diaphragm Spring & Circlip
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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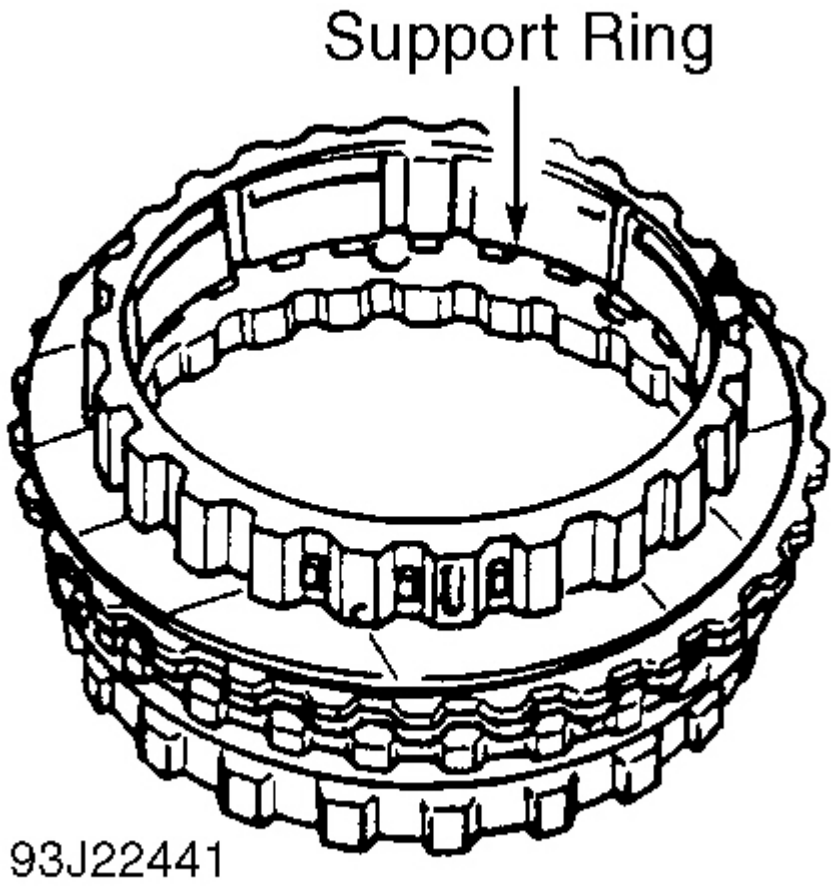

Fig. 46: Installing Support Ring
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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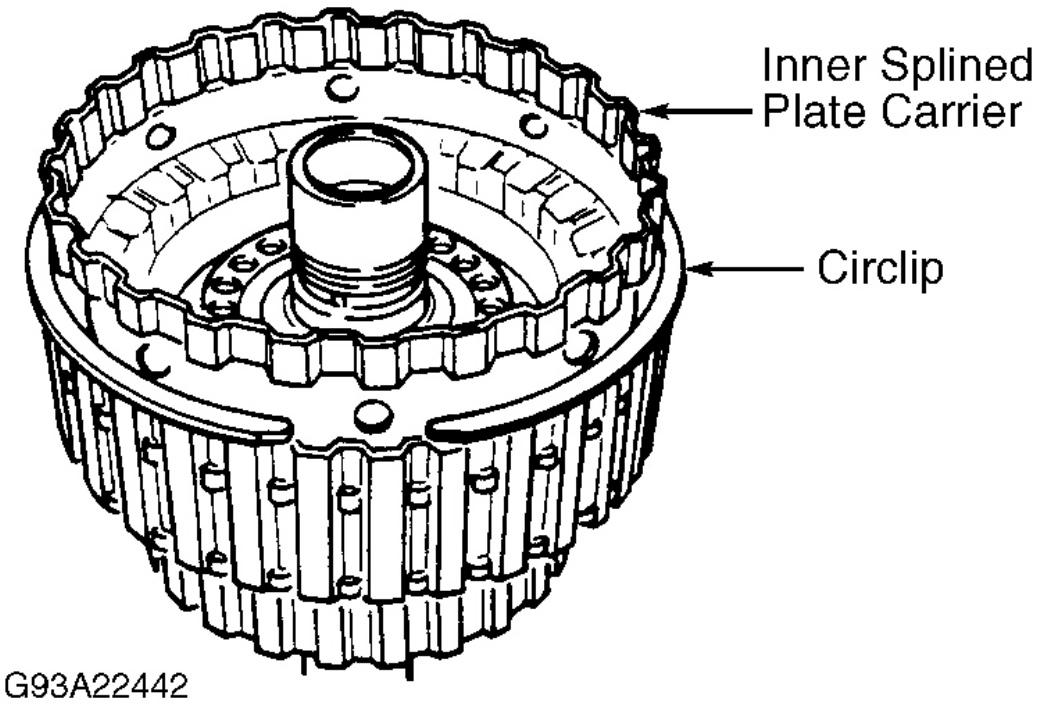

Fig. 47: Installing Clutch Housing Circlip
Courtesy of VOLKSWAGEN UNITED STATES, INC.

3RD-4TH APPLY CLUTCH

NOTE: Soak all friction-faced clutch plates in ATF for at least 15 minutes before installation.

1. Mark circlip for installation reference and remove. Disassemble clutch plates and round ring. See **Fig. 48** or **Fig. 49** . Compress spring support ring, and remove circlip. Remove diaphragm spring circlip and diaphragm spring. Remove clutch piston.
2. Remove front impeller seal rings. Do not remove inner impeller seal rings unless damaged. Check for worn or damaged parts and replace as necessary.
3. Ensure check ball in clutch housing is not damaged. Piston seal is part of piston. If damaged, replace 3rd-4th apply clutch piston. Reassemble 3rd-4th apply clutch. See **CLUTCH PLATE APPLICATIONS** .

NOTE: Assembled clutch clearance specification is not available from manufacturer. Ensure curved side of diaphragm spring faces piston. Ensure rounded side of round ring and rounded side of thrust plate face each other. Ensure top thrust plate is installed with shouldered side facing circlip.

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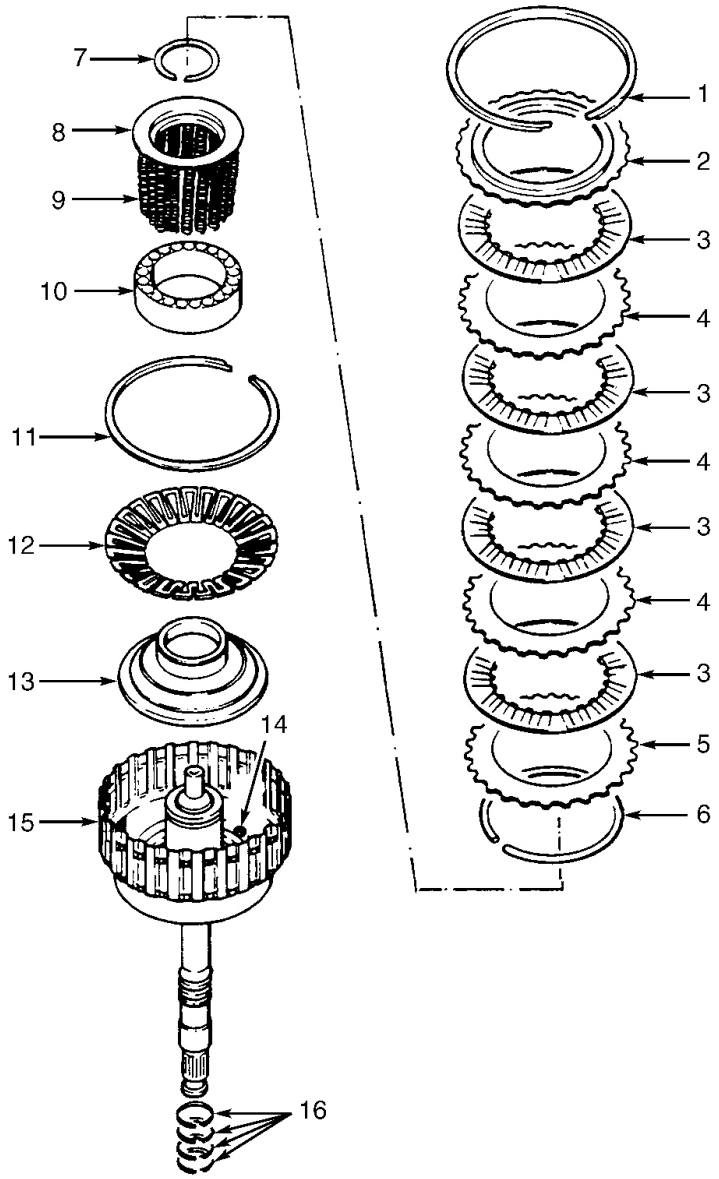

1. Circlip
2. Pressure Plate
3. Inner Splined Plate
4. Outer Splined Plate
5. Thrust Plate
6. Corrugated Ring
7. Circlip
8. Spring Support Ring
9. Springs
10. Spring Support Plate
11. Circlip
12. Diaphragm Spring
13. Piston
14. Check Ball
15. 3rd-4th Clutch Housing
16. Piston Rings

Fig. 48: Exploded View Of 3rd-4th Apply Clutch (Early 1993)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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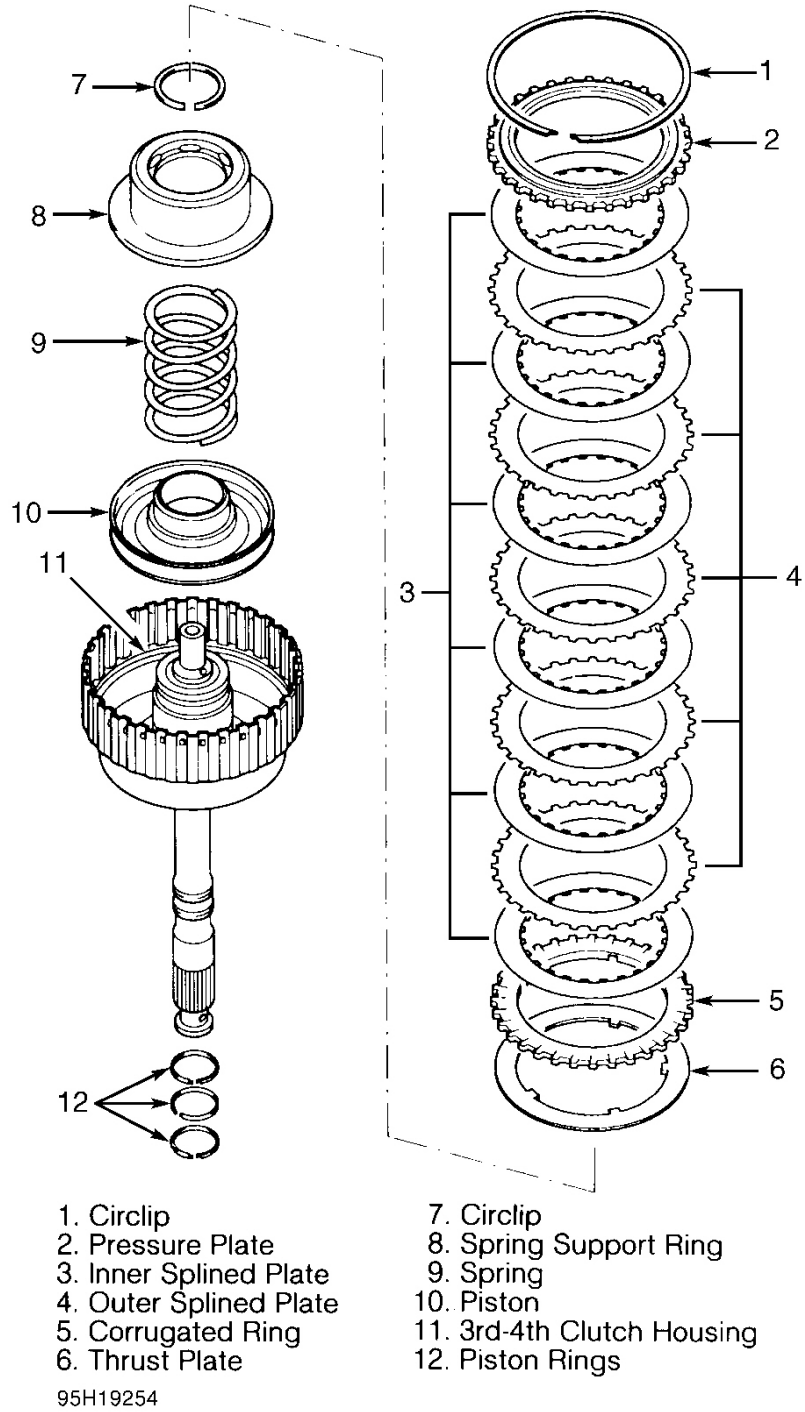

1. Circlip
2. Pressure Plate
3. Inner Splined Plate
4. Outer Splined Plate
5. Corrugated Ring
6. Thrust Plate
7. Circlip
8. Spring Support Ring
9. Spring
10. Piston
11. 3rd-4th Clutch Housing
12. Piston Rings

Fig. 49: Exploded View Of 3rd-4th Apply Clutch (Late 1993 & 1994)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

TRANSAXLE REASSEMBLY

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FINAL DRIVE & TRANSFER GEARS

NOTE: Reassembly procedures include bearing and shim adjustments. Perform all steps in the order given. If no parts were replaced, skip adjustment steps and reassemble final drive and transfer gear assembly using NEW seals. Ensure turning torque of complete assembly is within specifications. See ADJUSTMENT & REASSEMBLY (INPUT TRANSFER GEAR) . If turning torque is not within specifications, check all adjustments.

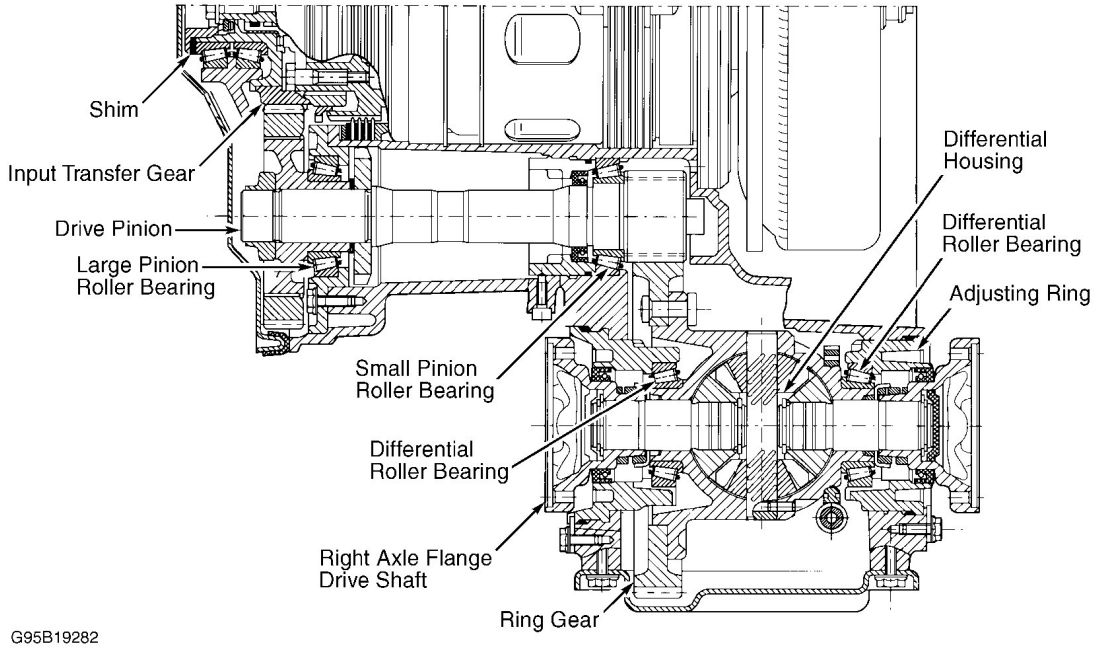

Fig. 50: Locating Final Drive Roller Bearings, Races & Adjustment Shims (096 Shown; 098 Similar)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Adjustment (Drive Pinion Roller Bearings)

1. Install drive pinion assembly with smaller bearing and inner bearing support (with pinion seal and "O" ring). Install parking lock gear (rounded side facing drive pinion gear), park lock lug and large pinion bearing race support.

NOTE: Install drive pinion seal with lip opening facing closest roller bearing.

2. If reusing drive pinion and large pinion bearing, Do not remove existing shims from drive pinion shaft. See **Fig. 51** . Go to step 4 . If replacing drive pinion and/or pinion bearings, install large pinion roller bearing to drive pinion.
3. Remove large roller bearing race support. Place two .06" (1.5 mm) thick shims onto drive pinion shaft. See **Fig. 51** . Install large roller bearing race support.
4. Install output drive pinion gear and nut. See **Fig. 42** . Engage parking lug to lock drive pinion shaft.

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Tighten nut to 184 ft. lbs. (250 N.m).

5. If reusing drive pinion and large pinion bearing, go to step 9 . If replacing drive pinion and/or pinion bearings, go to next step.
6. Do not rotate drive pinion. Position dial indicator assembly on transaxle case. See **Fig. 52** . Move drive pinion up and down, do not rotate. Measure and record end play.

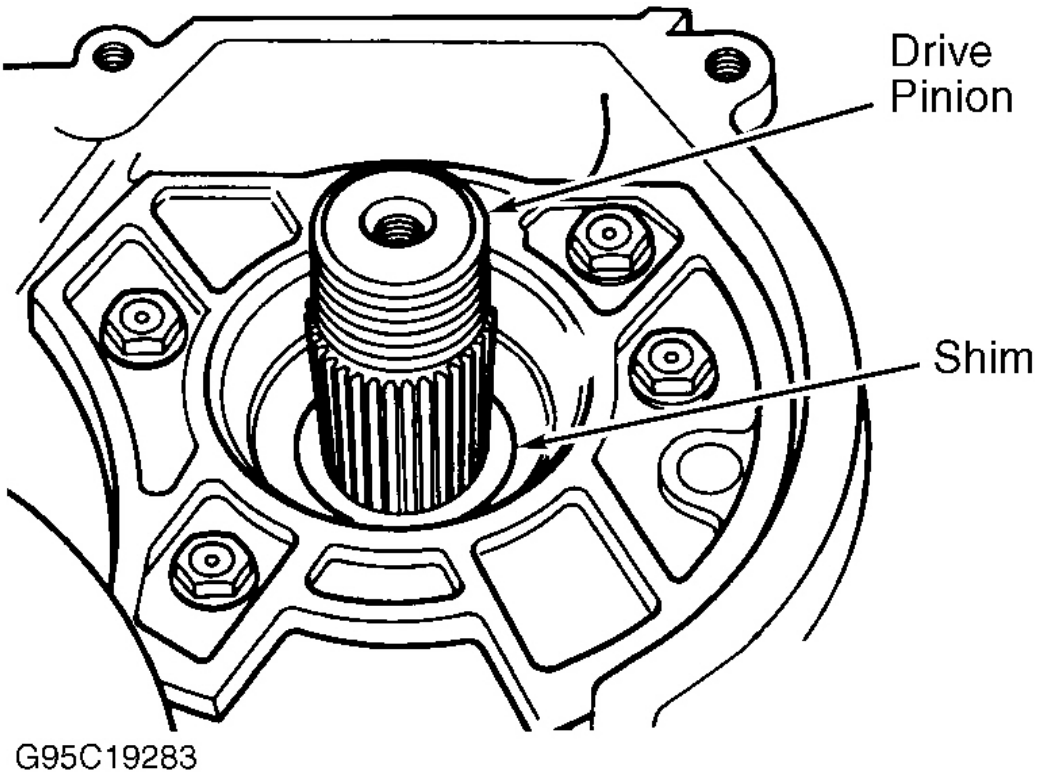

Fig. 51: Installing Drive Pinion Shim
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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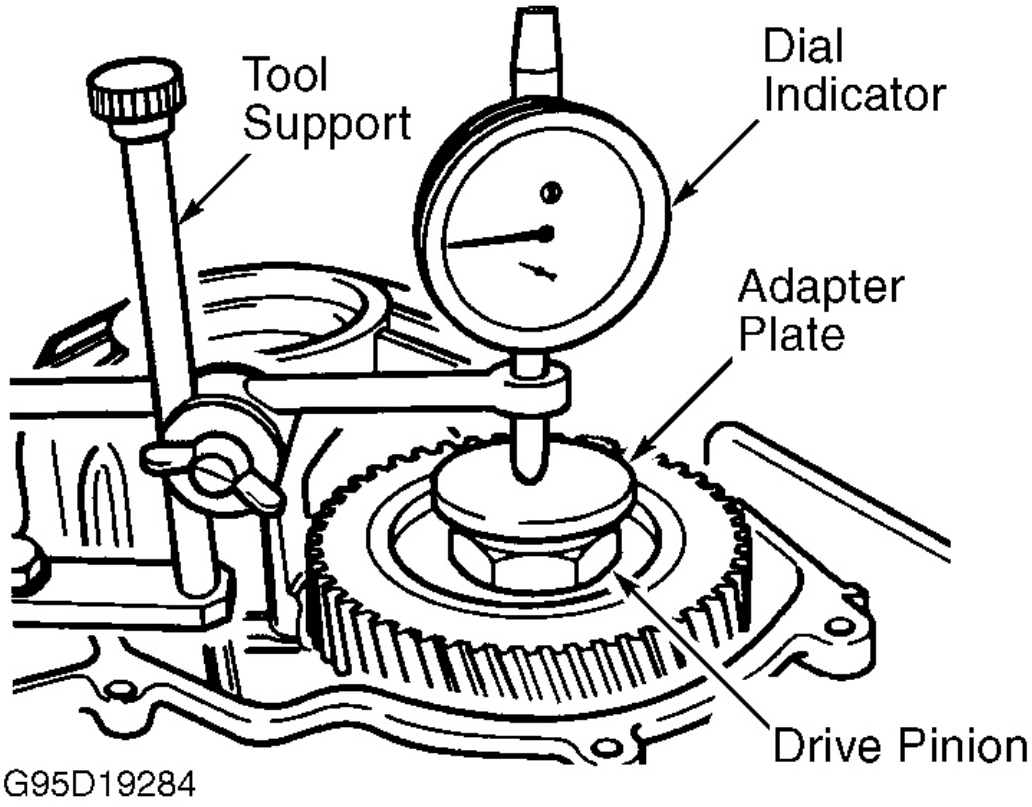

Fig. 52: Checking Drive Pinion Roller Bearing End Play
Courtesy of VOLKSWAGEN UNITED STATES, INC.

7. Add .008" (.22 mm) to end play measured in step 6 . This is shim thickness required to preload pinion cover roller bearing. See **Fig. 50** . Shims are available in thickness ranging from .040-.106" (1.00-2.70 mm), in .001" (.025 mm) increments.
8. Remove nut, drive pinion gear and bearing. Install shim calculated in step 7 . Apply gear oil to bearings. Install drive pinion gear and nut. Tighten nut to 250 ft. lbs. (339 N.m) to seat bearings.
9. Using an INCH-lb. torque wrench, rotate the torque wrench at least 8 turns to determine turning torque. Measure the turning torque of the drive pinion roller bearings. See **Fig. 53** . See**DRIVE PINION ROLLER BEARING SPECIFICATIONS** table. After turning torque is correct, bend locking plate on nut.

DRIVE PINION ROLLER BEARING SPECIFICATIONS

Application	Turning Torque
New Bearings	7-11 INCH Lbs. (.73-1.20 N.m)
Used Bearings	(1) Same As Before Disassembly
(1) Recorded during disassembly. See **FINAL DRIVE & TRANSFER GEARS** under TRANSAXLE	

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(1) DISASSEMBLY.

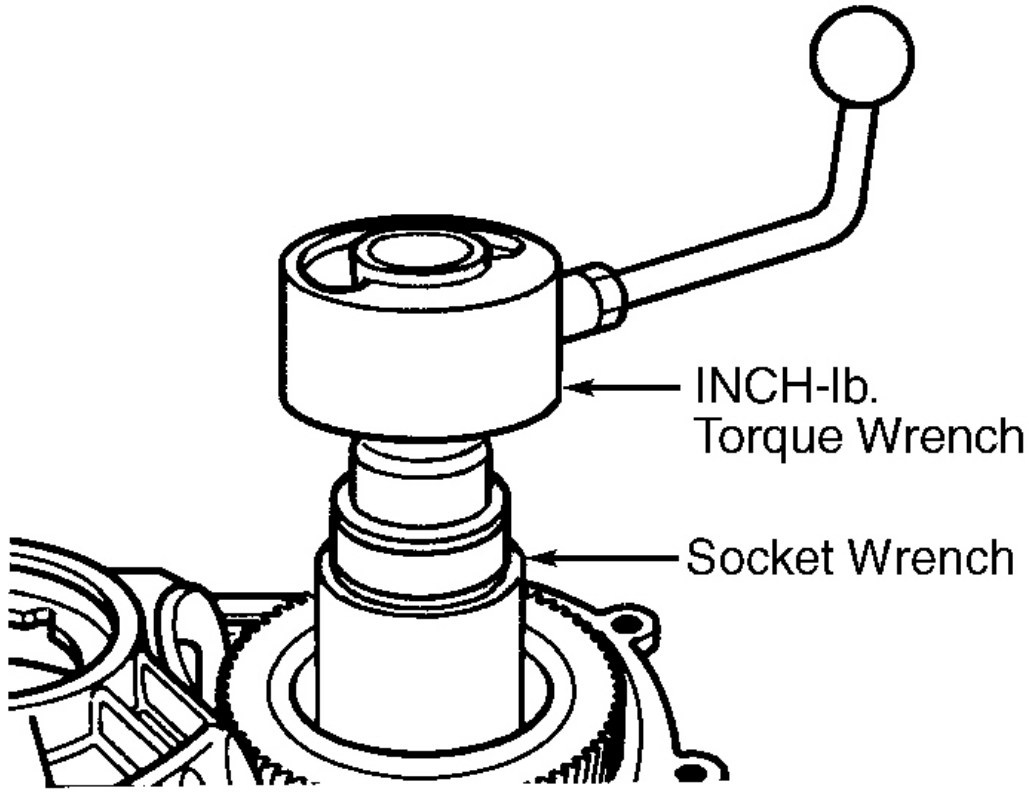

Fig. 53: Checking Pinion Roller Bearing Preload
Courtesy of AUDI OF AMERICA, INC.

Adjustment & Reassembly (Input Transfer Gear)

1. Ensure inner race for roller bearing is installed in transaxle case.
2. Install input transfer gear with roller bearing and axial needle bearing (flat side facing input gear) into transaxle case. See **Fig. 1** , **Fig. 50** and **Fig. 55** . Align lugs on outer roller bearing to fit between lugs on inner roller bearing. See **Fig. 54** .
3. Install outer roller bearing (without dished washer or shim) on input transfer gear. See **Fig. 50** and **Fig. 55** . Engage parking gear. Using an Allen-head socket, tighten fastener nut to 74 ft. lbs. (100 N.m). See **Fig. 56** .
4. Remove fastener nut. Using a dial indicator, measure distance between input transfer gear and inner race of roller bearing. See **Fig. 57** . Measure thickness of dished washer.

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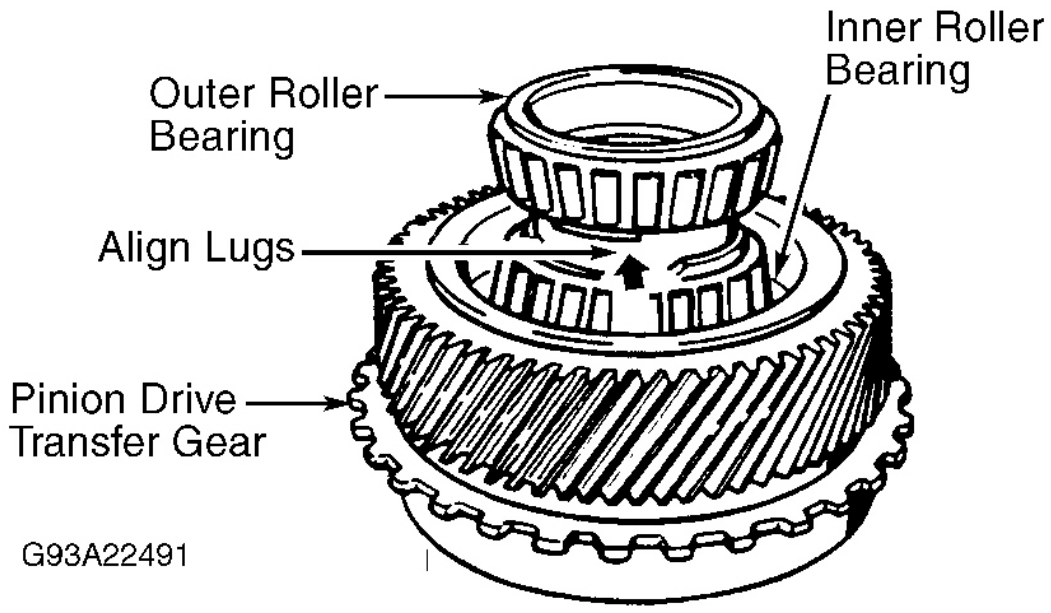

Fig. 54: Aligning Lugs On Input Transfer Gear Roller Bearings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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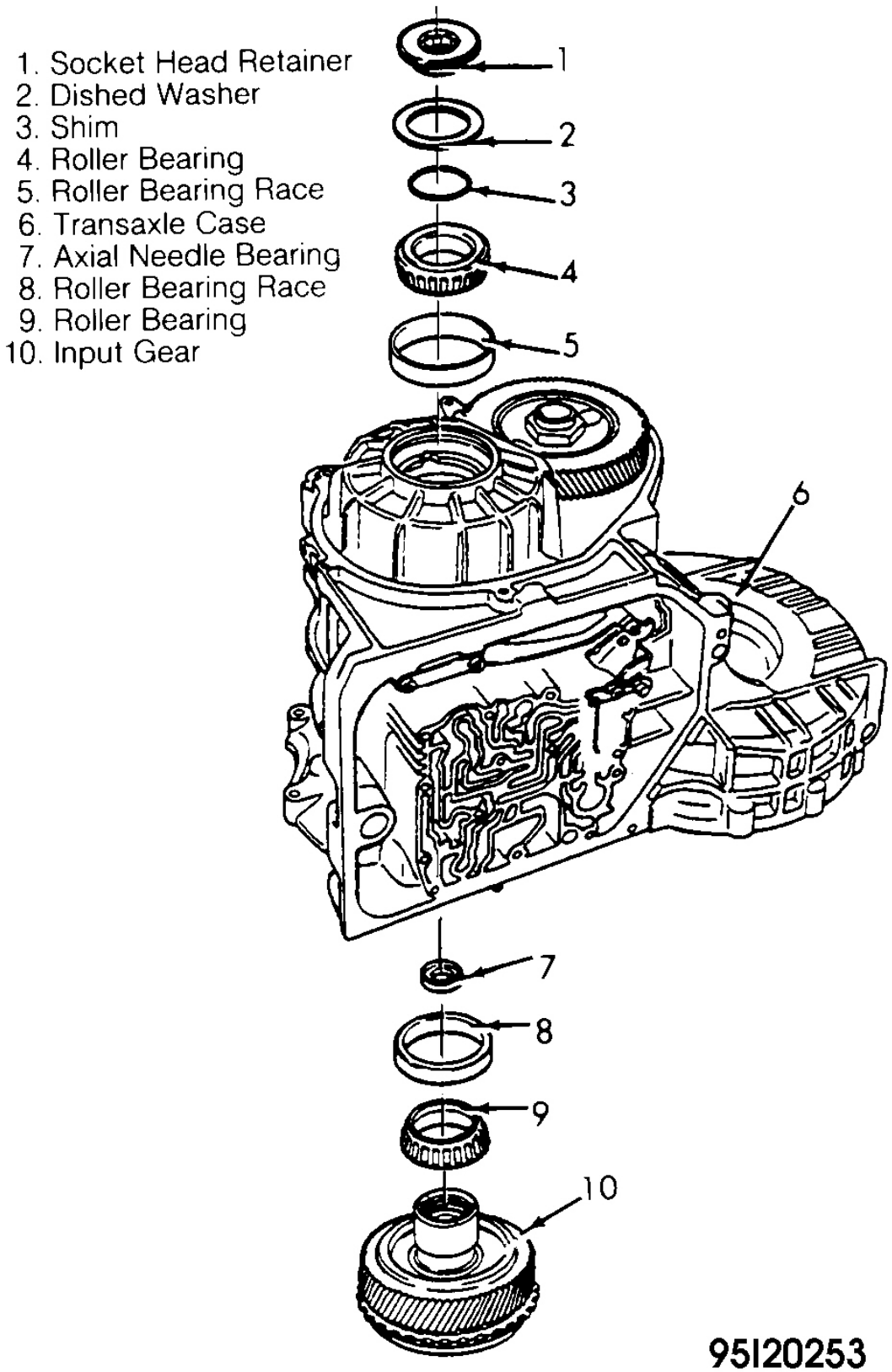

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Fig. 55: Locating Input Transfer Gear Assembly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

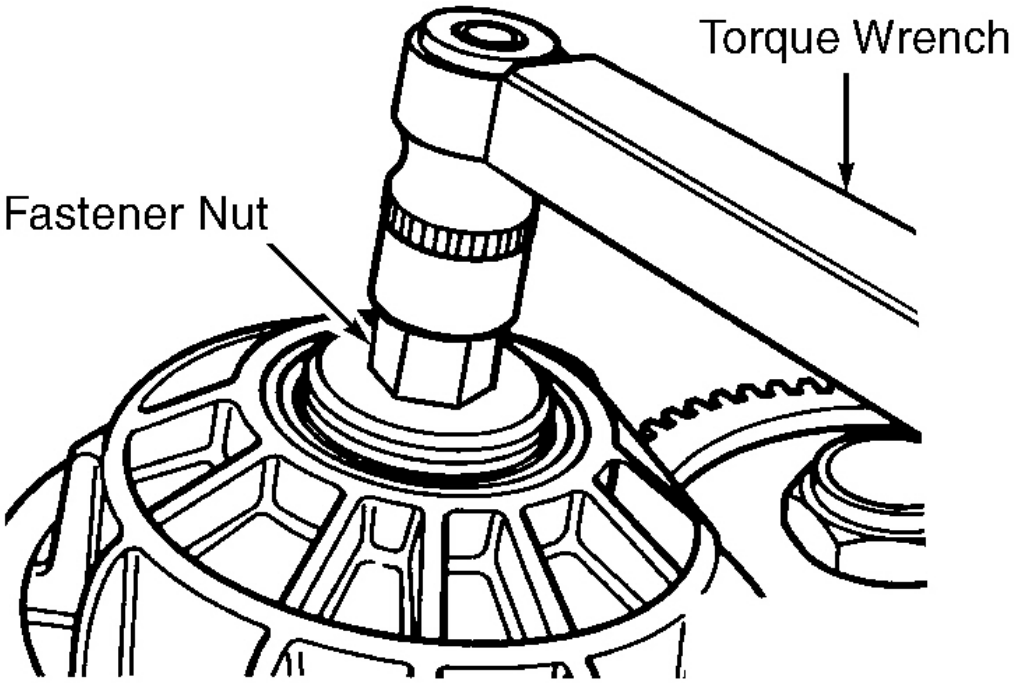

Fig. 56: Tightening Fastener Nut On Input Transfer Gear Roller Bearings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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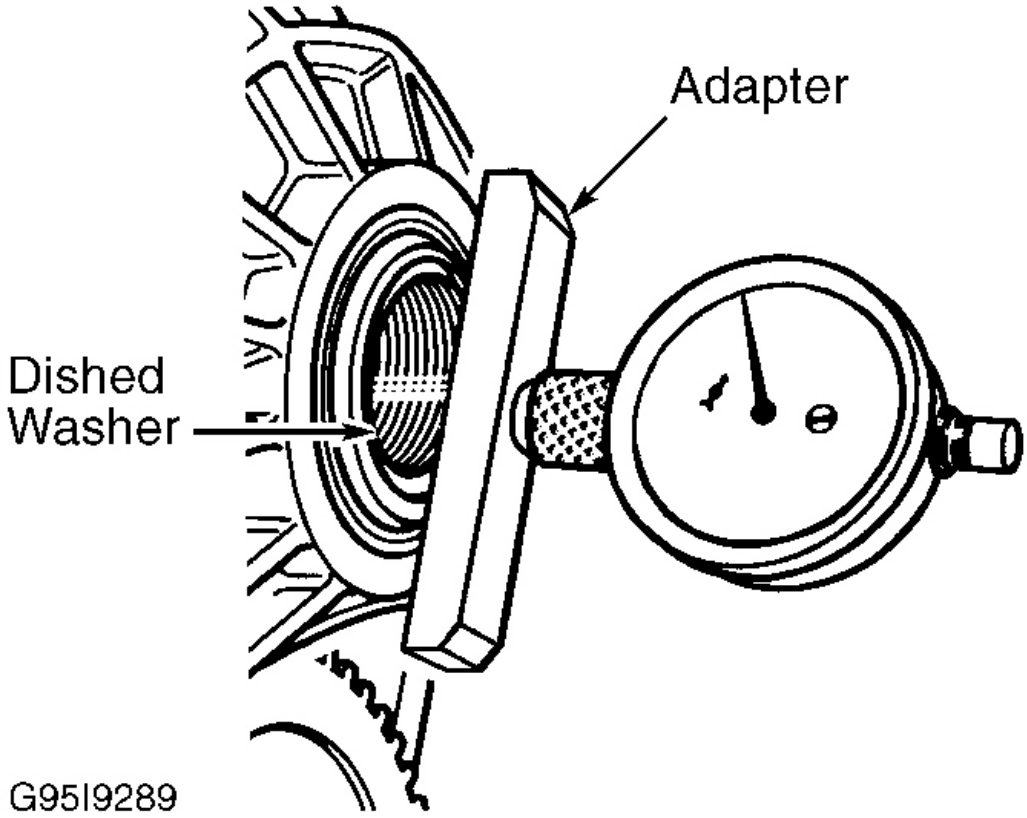

Fig. 57: Checking Distance Between Input Transfer Gear & Inner Race Of Roller Bearings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

5. Add dished washer thickness to distance measured in step 3 . Subtract .007" (.18 mm) to obtain shim thickness for desired roller bearing preload. Shims are available in thickness ranging from .040-.106" (1.00-2.70 mm), in .001" (.025 mm) increments.
6. Install selected shim. Install dished washer with curved side facing fastener nut. Apply ATF to bearings. Install and tighten fastener nut to 185 ft. lbs. (250 N.m) to seat bearings.
7. Using an INCH-lb. torque wrench, rotate torque wrench at least 8 turns to determine turning torque. Measure combined turning torque of pinion and input transfer gear roller bearings. See **INPUT TRANSFER GEAR ROLLER BEARING SPECIFICATIONS** table. Also, see **Fig. 53** .

INPUT TRANSFER GEAR ROLLER BEARING SPECIFICATIONS

Application	Turning Torque
New Bearings	
Without Drive Pinion	18 INCH Lbs. (2.0 N.m)

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Bearings	
With Drive Pinion Bearings	(1) 27 INCH Lbs. (3.0 N.m)
Used Bearings	(2) Same As Before Disassembly

(1) Based on a drive pinion torque of 9 INCH Lbs. (1.0 N.m).

(2) Recorded during disassembly. See **FINAL DRIVE & TRANSFER GEARS** under TRANSAXLE DISASSEMBLY.

8. Remove fastener nut. If necessary, select a shim and recheck roller bearing preload. If roller bearing preload is okay, apply Locking compound to shaft side of roller bearing.
9. Align lugs with notches of opposite roller bearing. See **Fig. 54** . Install axial needle bearing with flat side facing drive shaft. Engage parking gear lug. Install fastener nut and tighten to 185 ft. lbs. (250 N.m).

Final Drive Assembly

1. Using press and adapter, press differential bearing race and shim from torque converter housing. See **Fig. 33** and **Fig. 58** . Reinstall differential bearing race or NEW race, as required, without shim, using press and adapters. Oil bearings and place differential assembly inside transaxle with Special Tool (VW 521/4 and VW 521/8). See **Fig. 59** .
2. Bolt differential housing to torque converter housing, using every other bolt. Tighten bolts to 18 ft. lbs. (25 N.m). Select appropriate preload shim by measuring end play. Do not rotate drive pinion. Position adapter plate and dial indicator assembly on transaxle case. See **Fig. 52** . Move differential assembly up and down. Do not rotate. Measure and record end play.

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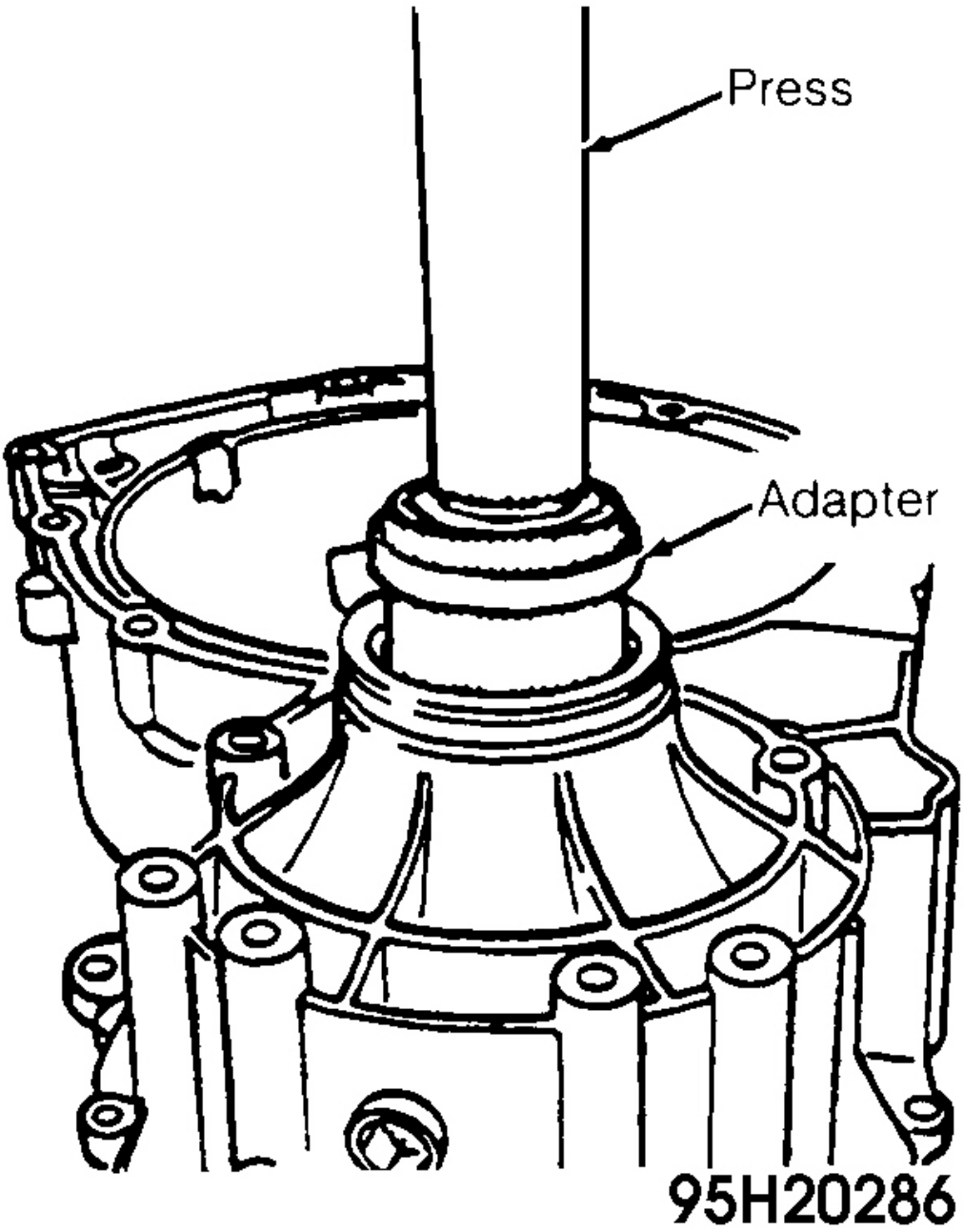

Fig. 58: Removing Differential Shim
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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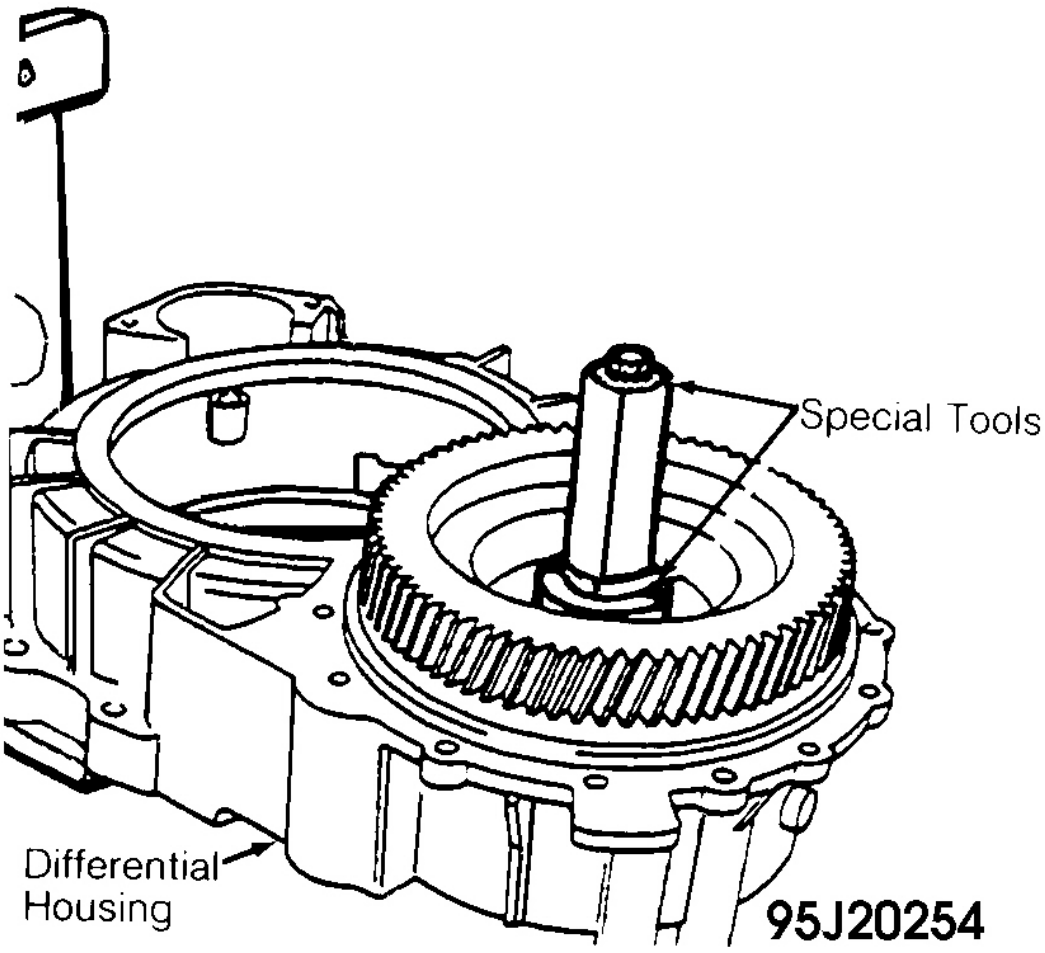

Fig. 59: Differential End Play Setup
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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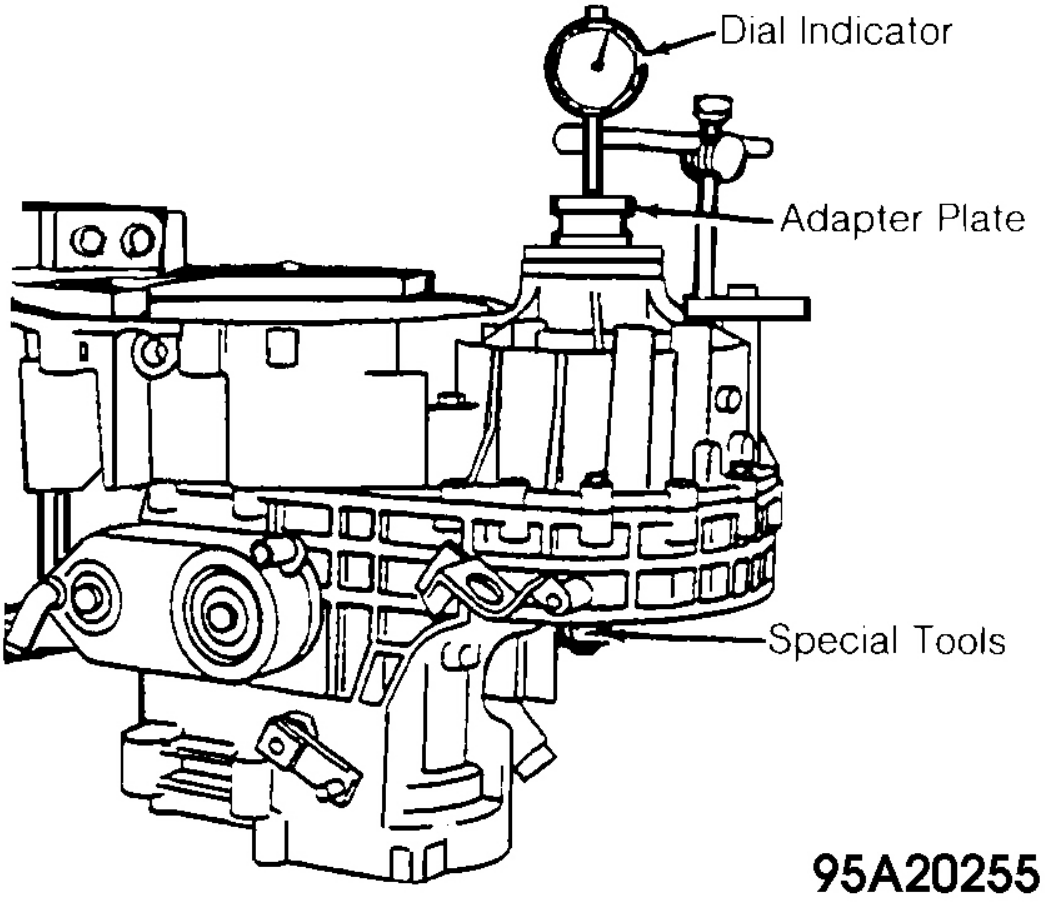

Fig. 60: Checking Differential End Play
Courtesy of VOLKSWAGEN UNITED STATES, INC.

3. Add .008" (.22 mm) to end play measured in step 2 . This is shim thickness required to preload differential roller bearings. See **Fig. 50** . Shims are available in thickness ranging from .026-.055" (.65-1.40 mm), in .002" (.05 mm) increments. If computed thickness is greater than largest shim, 2 shims may be used. Remove dial indicator assembly and install shim behind differential bearing race.
4. Using INCH-lb. torque wrench, rotate torque wrench at least 8 turns to determine turning torque. Ensure turning torque of differential assembly is 4-6 INCH lbs. (.5-.9 N.m) greater than turning torque measured after drive pinion assembly.
5. Install NEW circlips on axle shafts by pushing old circlips off while installing new circlips. See **Fig. 61** . Using driver, install axle seal. Install short axle shaft, using a plastic hammer.

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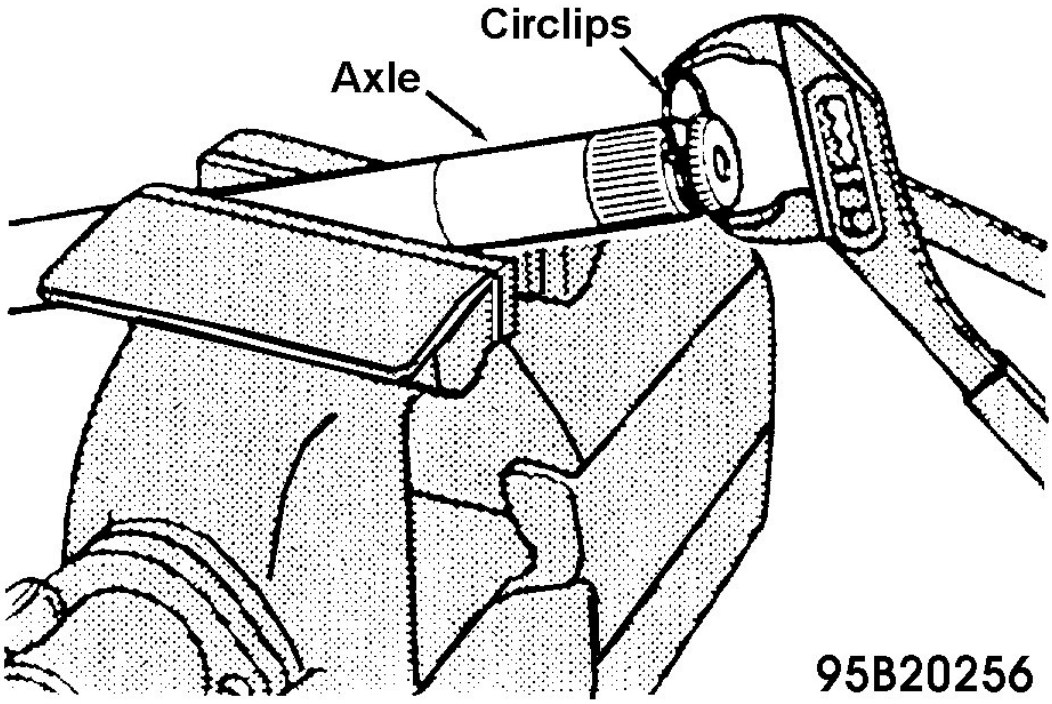

Fig. 61: Installing Circlips To Axles
Courtesy of VOLKSWAGEN UNITED STATES, INC.

6. Using press and adapters, install axle needle bearing in bearing housing. See **Fig. 62** . Install axle needle bearing circlip and seal.
7. Install bearing housing and "O" ring. Tighten bolts to 30 ft. lbs. (40 N.m), then tighten 90° further. Using press, install drive flange on long axle shaft. Install long axle shaft and drive flange assembly, using a plastic hammer.
8. Install circlip and drive flange cap. Install speedometer and guide bushing. Install breather pipe and cap, if removed.

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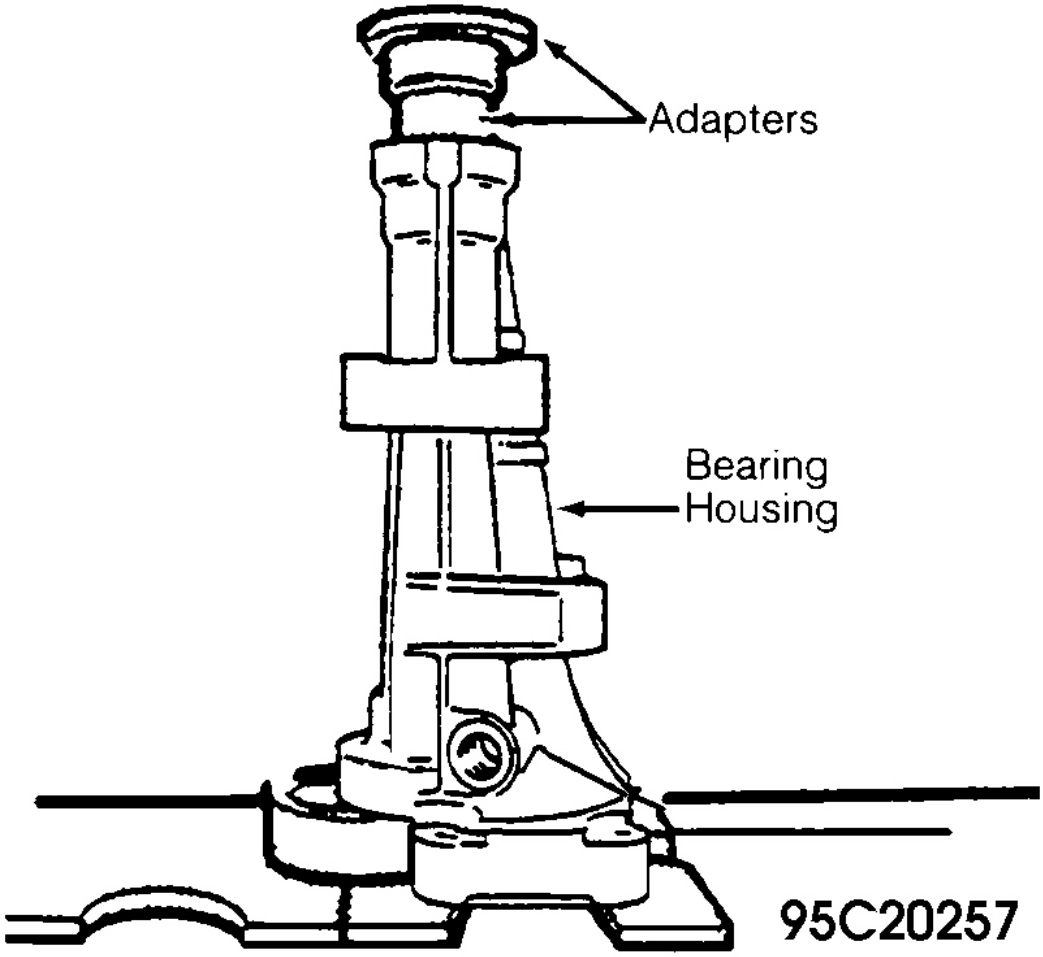

Fig. 62: Installing Axle Needle Bearings
Courtesy of VOLKSWAGEN UNITED STATES, INC.

TRANSAXLE

NOTE: Soak all friction-faced clutch plates in ATF for at least 15 minutes before installation. Apply assembly lubrication to all bushings, washers, shims and bearings before installation. See Fig. 19 .

1. Input transfer gear, drive pinion and differential assemblies should be adjusted and installed at this time. Install axial needle bearing to input transfer gear. See **Fig. 63** . Install "O" ring and planetary carrier. On early 1993, install small sun gear. On all, install axial needle bearing and washers. See **Fig. 26** and **Fig. 64** . Install end plate shim for reverse brake clutch plates. See **Fig. 65** .
2. Install reverse brake clutch plates. See **Fig. 66** . See the **BRAKE CLUTCH PLATE APPLICATIONS** table. Using Assembly Ring (VW 3267), install one-way clutch and secure using circlip. See **Fig. 67** and

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Fig. 68 .

3. Using a feeler gauge, check installed reverse brake clutch clearance. See **Fig. 69** . Clearance should be .047-.071" (1.2-1.8 mm). If clearance is not as specified, replace end plate shim. End plate shims are available in thicknesses ranging from .04" (1.0 mm) to .07" (1.9 mm) in .004" (.10 mm) increments.

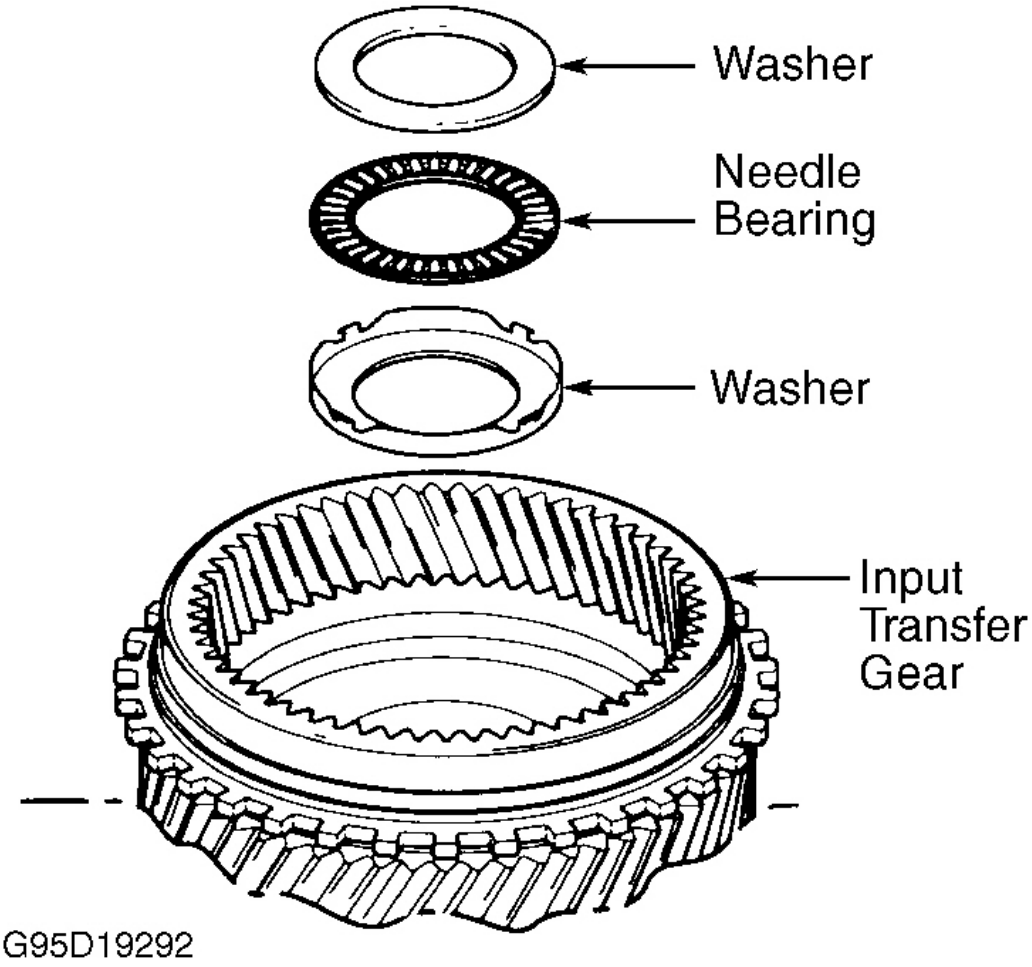

Fig. 63: Installing Axial Needle Bearing To Input Transfer Gear
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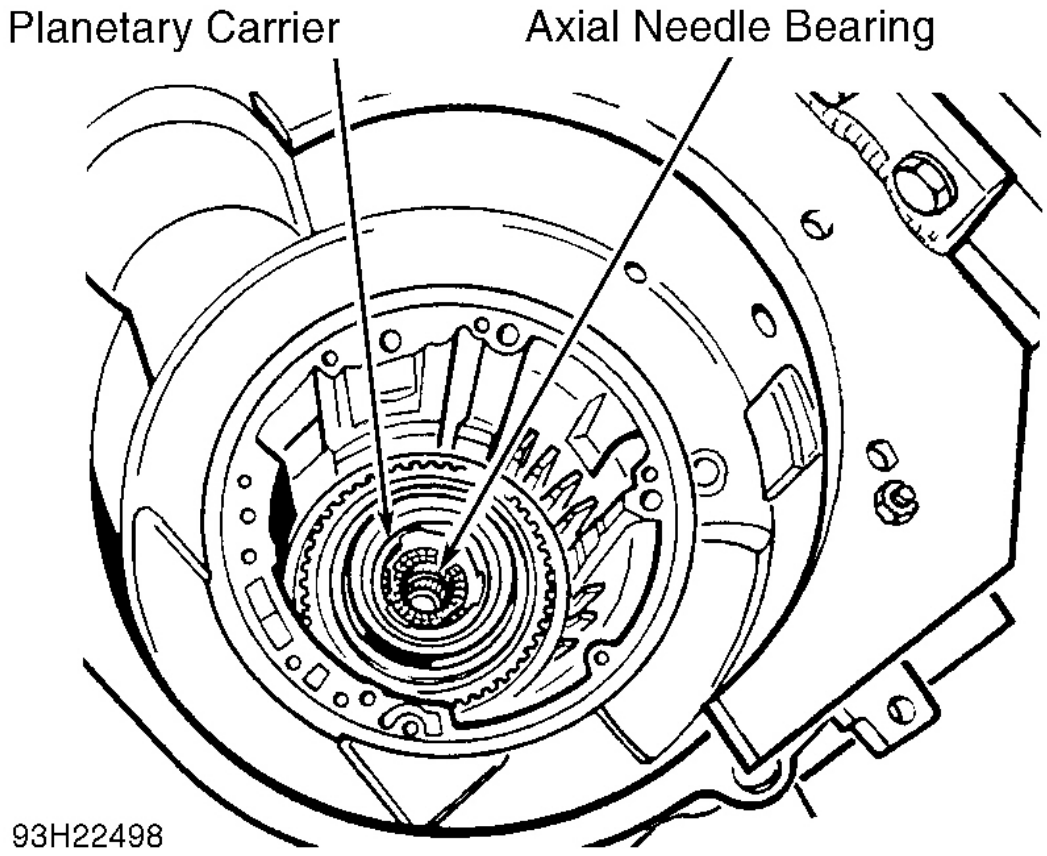

Fig. 64: Installing Planetary Carrier & Axial Needle Bearing
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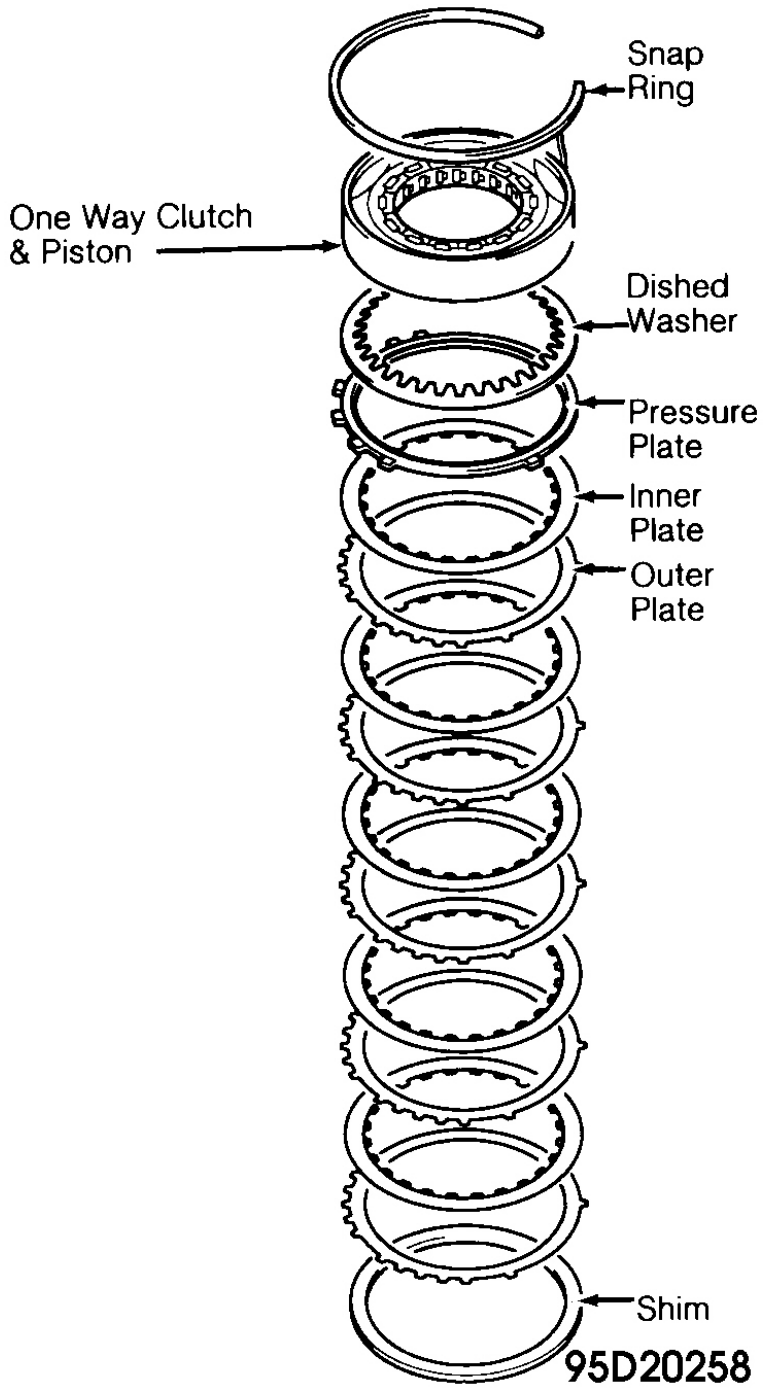

Fig. 65: Exploded View Reverse Brake Clutch Assembly
Courtesy of VOLKSWAGEN UNITED STATES, INC.

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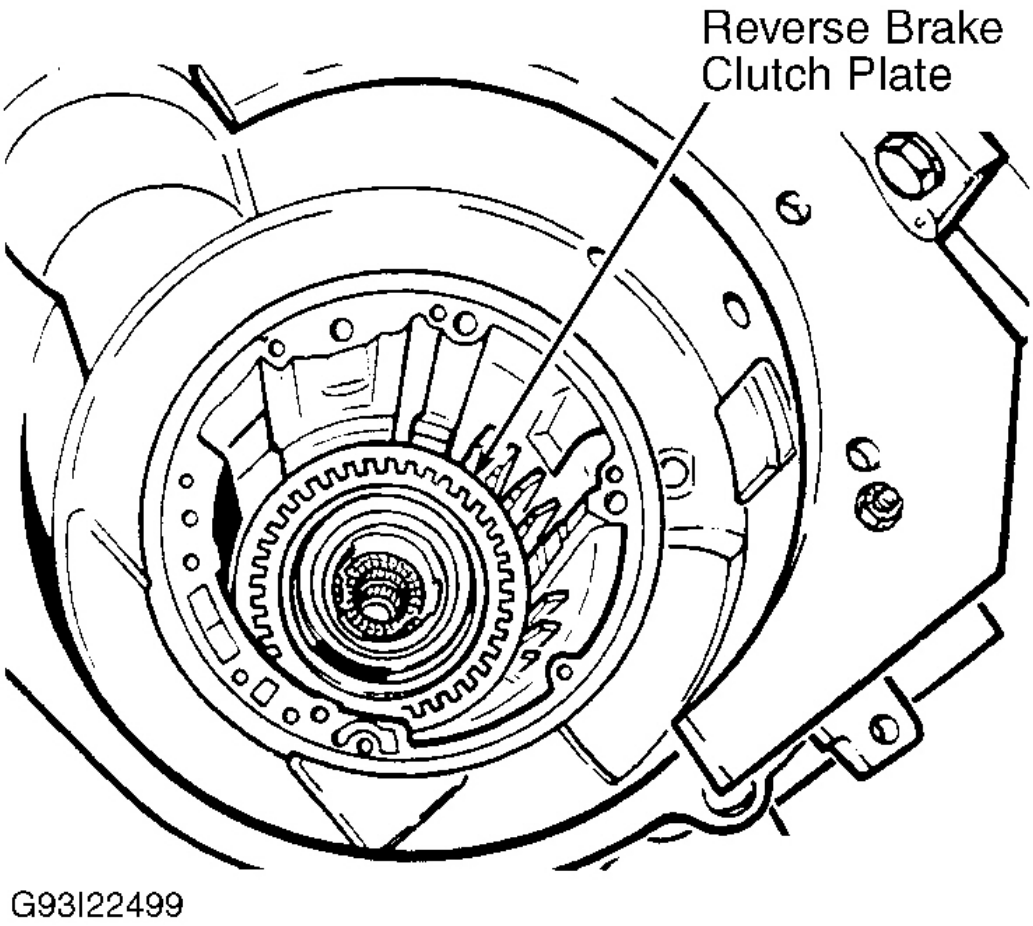

Fig. 66: Installing Reverse Brake Clutch Plates
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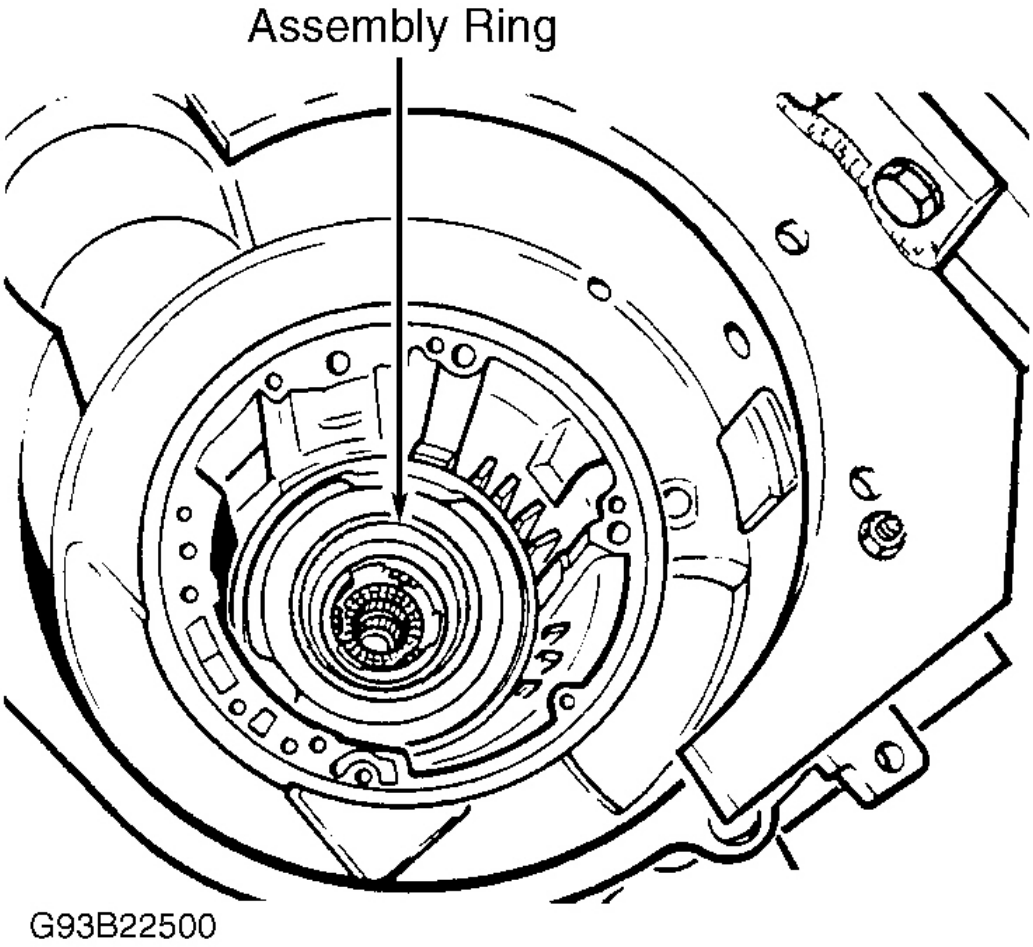

Fig. 67: Installing One-Way Clutch
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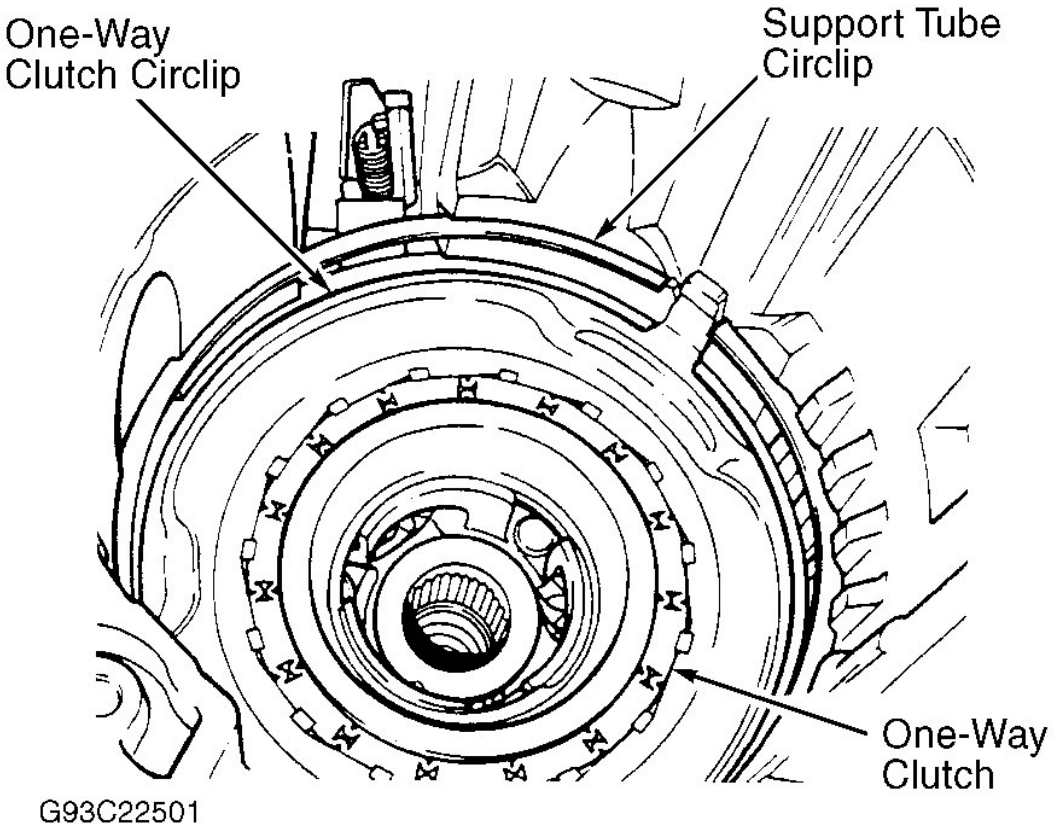

Fig. 68: Installing Circlips
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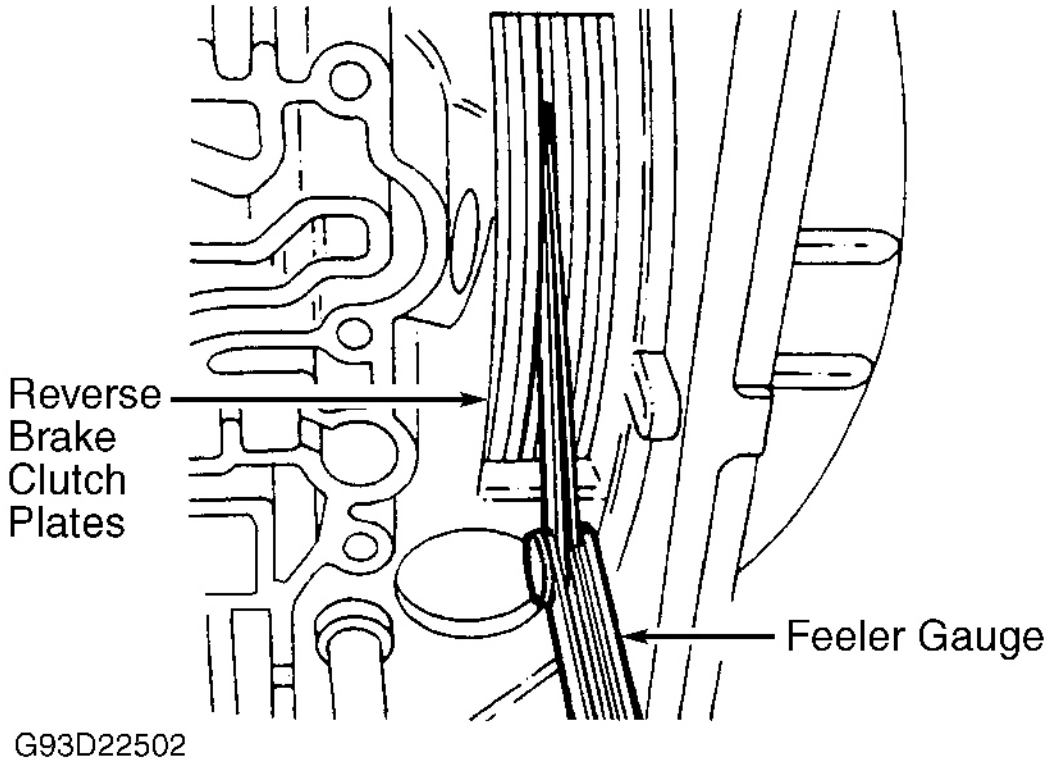

Fig. 69: Checking Reverse Brake Clutch Clearance
Courtesy of VOLKSWAGEN UNITED STATES, INC.

BRAKE CLUTCH PLATE APPLICATIONS

Application	Number Of Plates
Reverse Clutch	
Inner	6
Outer	6
2nd-4th Clutch	
Inner	5
Outer	6

4. Install rubber oil splash shield and lower circlip for support tube. See **Fig. 84** . Install washers, bearing and large sun gear. Install large sun gear drive shell. See **Fig. 85** .
5. Install small sun gear drive shell. Install small planetary drive shaft. See **Fig. 19** , **Fig. 71** and **Fig. 72** . Using a screwdriver, lock small sun gear drive shell to large sun gear drive shell. See **Fig. 73** . Install adjustment shim, washer and bolt on end of small planetary drive shaft. Tighten bolt to 22 ft. lbs. (30 N.m).
6. Ensure end play is .009-.014" (.23-.37 mm). If measured end play is not as specified, recheck assembly or

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adjustment. Refer to **PLANETARY CARRIER** under COMPONENT DISASSEMBLY & REASSEMBLY.

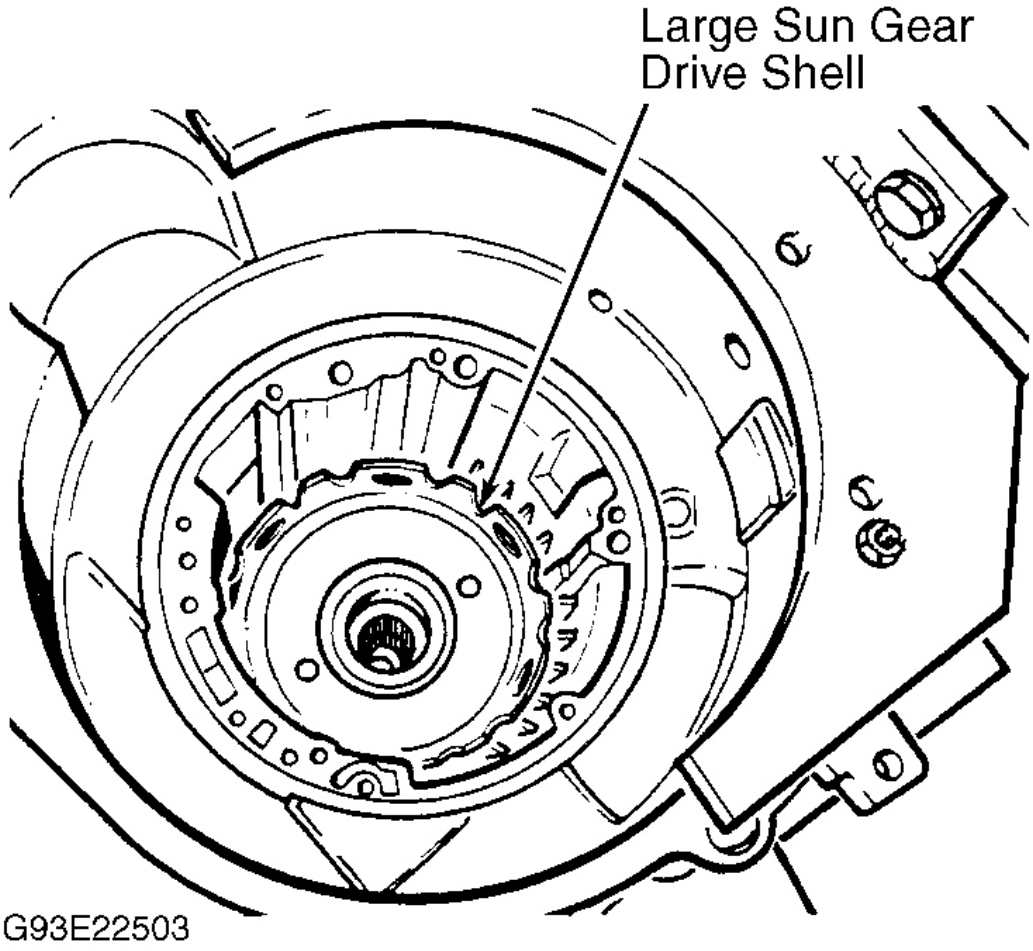

Fig. 70: Installing Large Sun Gear Drive Shell
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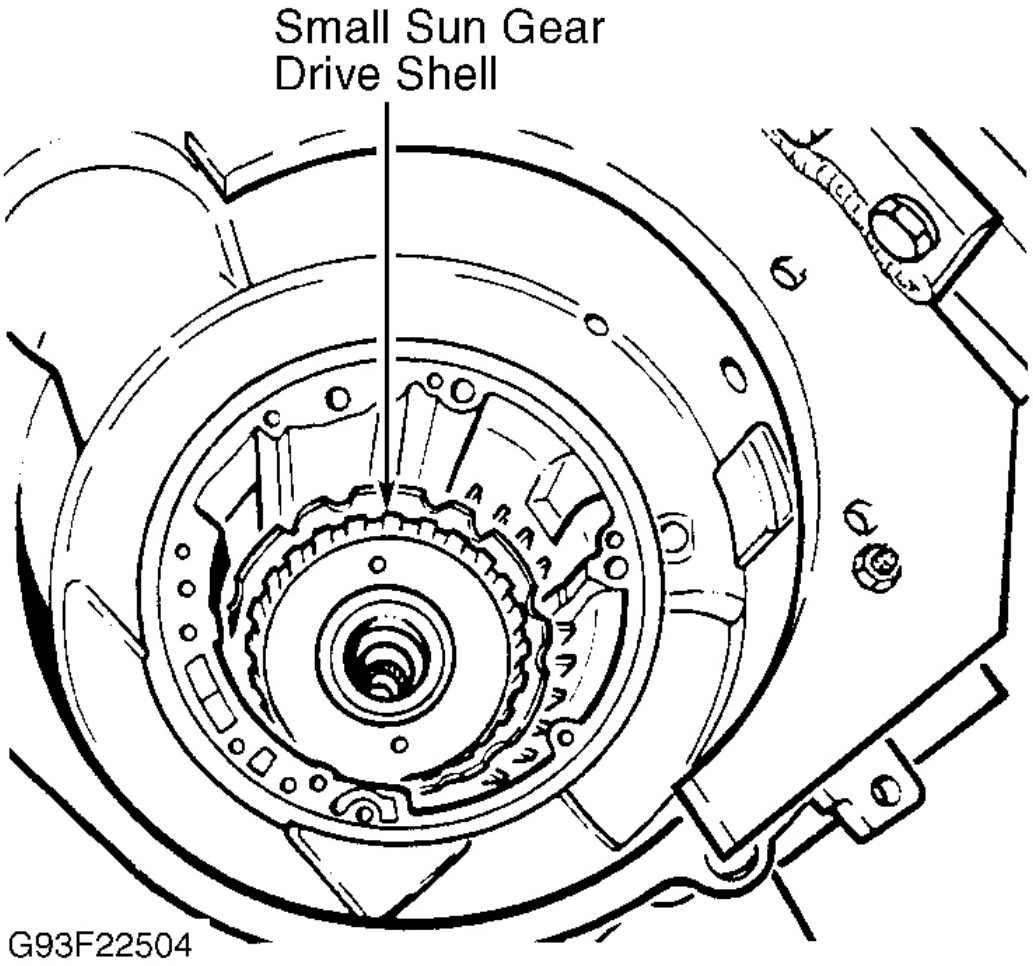

Fig. 71: Installing Small Sun Gear Drive Shell
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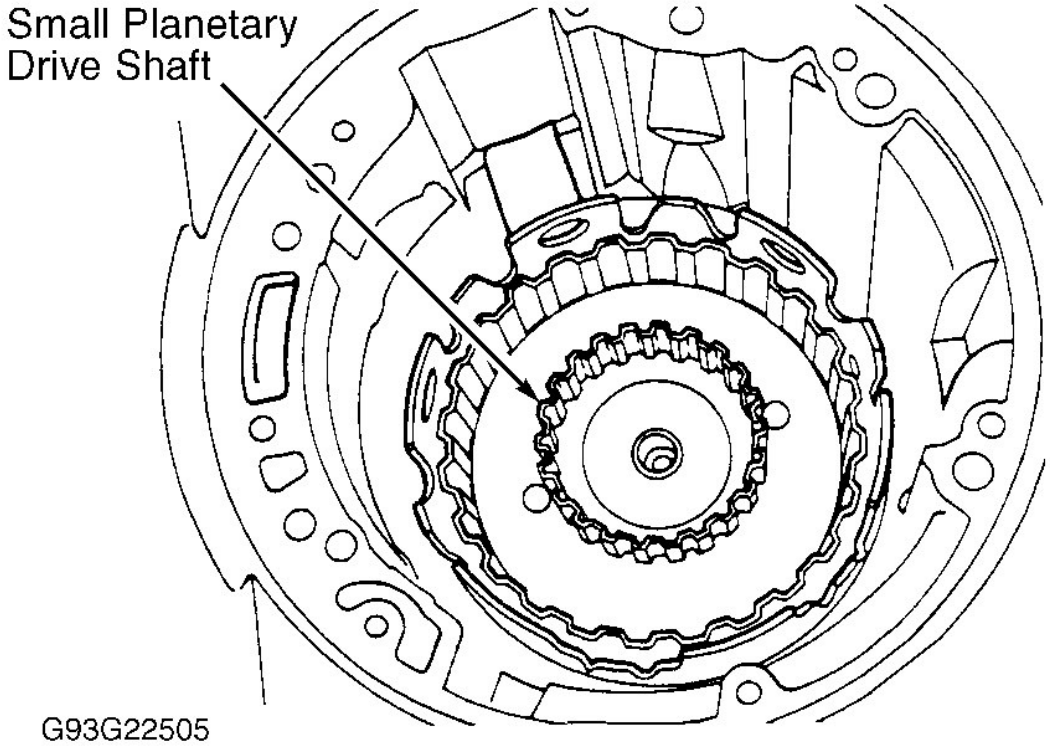

Fig. 72: Installing Small Planetary Drive Shaft
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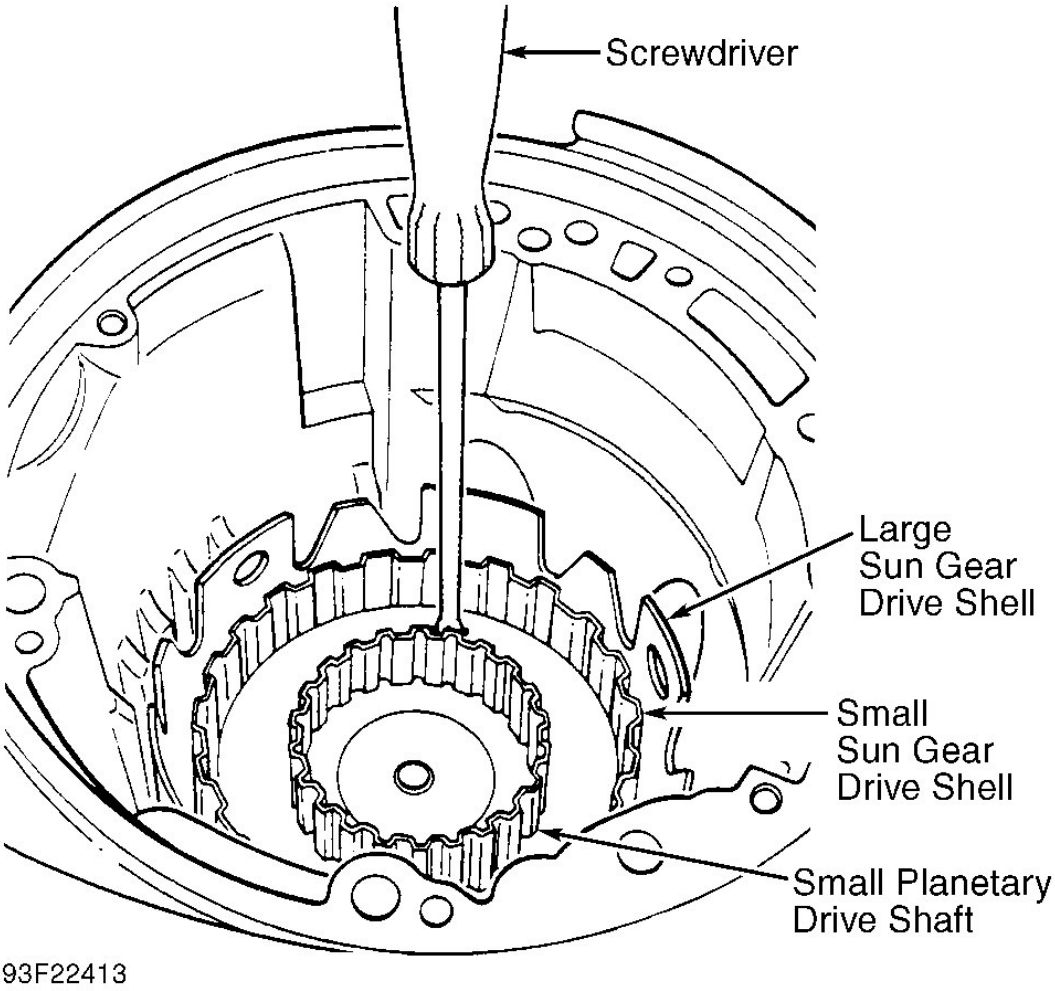

Fig. 73: Holding Small Sun Gear Drive Shell
Courtesy of VOLKSWAGEN UNITED STATES, INC.

7. Install bearing, washer, and impeller shaft and 3rd-4th apply clutch. See **Fig. 74** . Install bearing, washer and 1st-3rd apply clutch with turbine shaft assembly. See **Fig. 75** . Install thrust shims on 1st-3rd apply clutch housing. Install reverse apply clutch and support tube. See **Fig. 76** .

NOTE: Turbine shaft end play was measured before disassembly. If end play is okay, use original thrust shims. If end play is not okay or new parts are installed, calculate difference and install required thrust shims.

8. For checking purposes, install oil pump gasket and oil pump. See **Fig. 19** . Position dial indicator and Support (VW 387) on transaxle case. See **Fig. 77** .
9. Press dial indicator on turbine shaft, and apply .040" (1.0 mm) preload. Move turbine shaft up and down. Turbine shaft end play should be .019-.047" (.50-1.20 mm).

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10. If end play is okay, go to next step. If end play is not okay, install required thrust shims. Thrust shims are available in thicknesses ranging from .04" (1.0 mm) to .07" (1.8 mm) in .008" (.20 mm) increments. Recheck turbine shaft end play.
11. Remove oil pump and oil pump gasket. Install support tube and .12" (3.0 mm) thick outer splined plate for reverse apply clutch. Ensure groove on support tube engages wedge of one-way clutch. See **Fig. 19** .
12. Install friction plates and outer splined plates for reverse apply clutch into transaxle case. See **Fig. 78** . Install 3 springs and cap springs. Install 2nd-4th brake clutch plates. See **BRAKE CLUTCH PLATE APPLICATIONS** table. Also, see **Fig. 79** . Install 3 spring caps to springs.

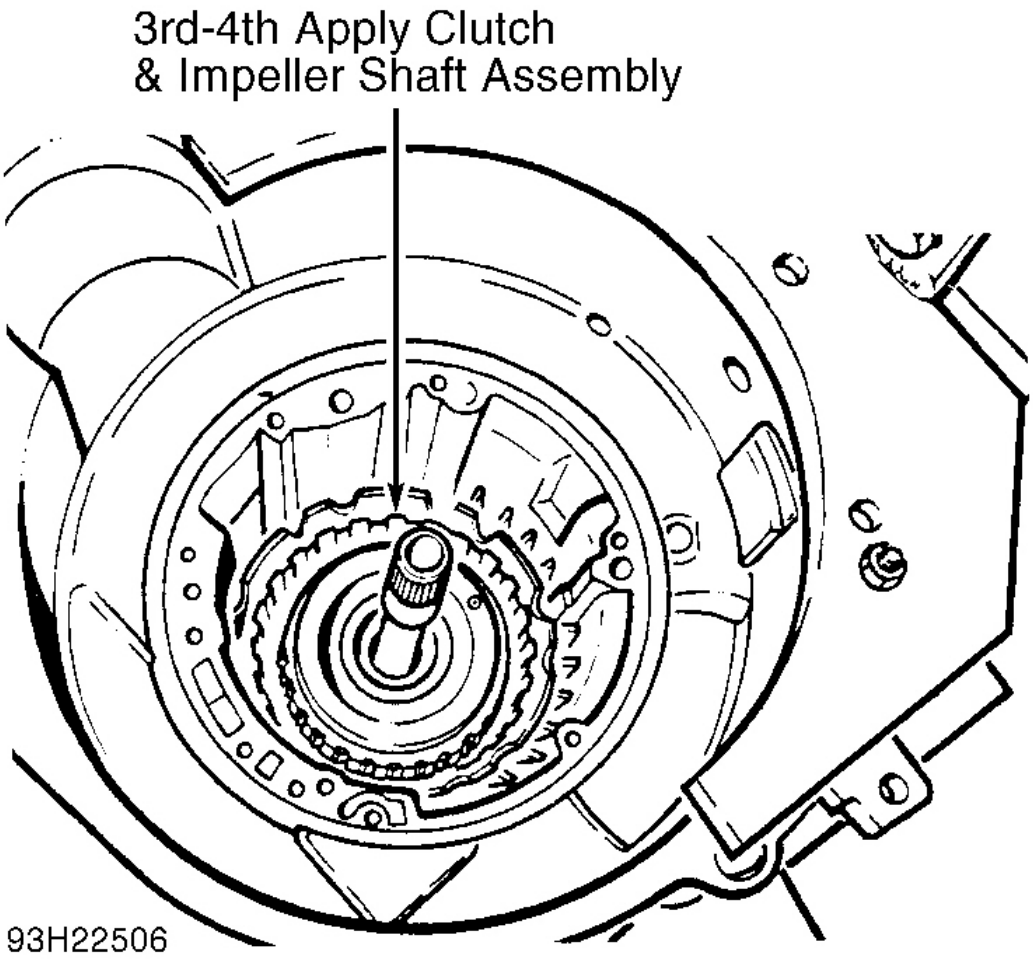

Fig. 74: Installing 3rd-4th Apply Clutch & Impeller Shaft
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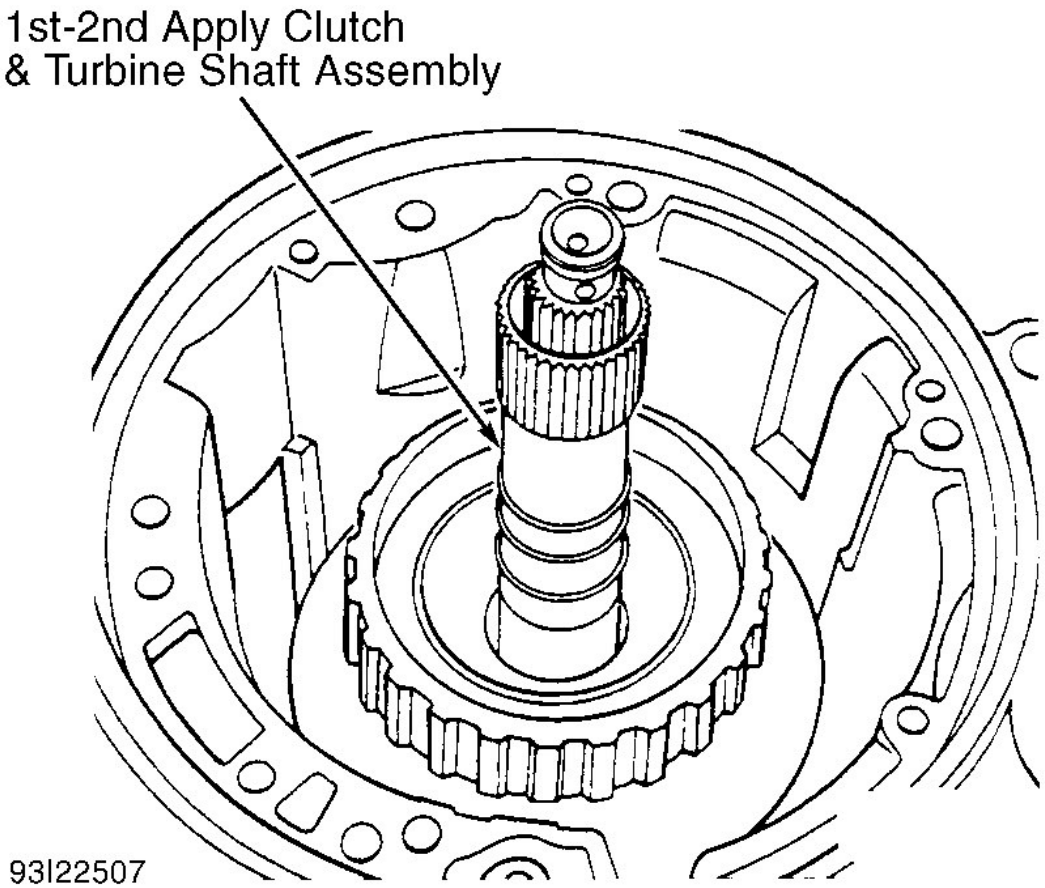

Fig. 75: Installing 1st-3rd Apply Clutch & Turbine Shaft
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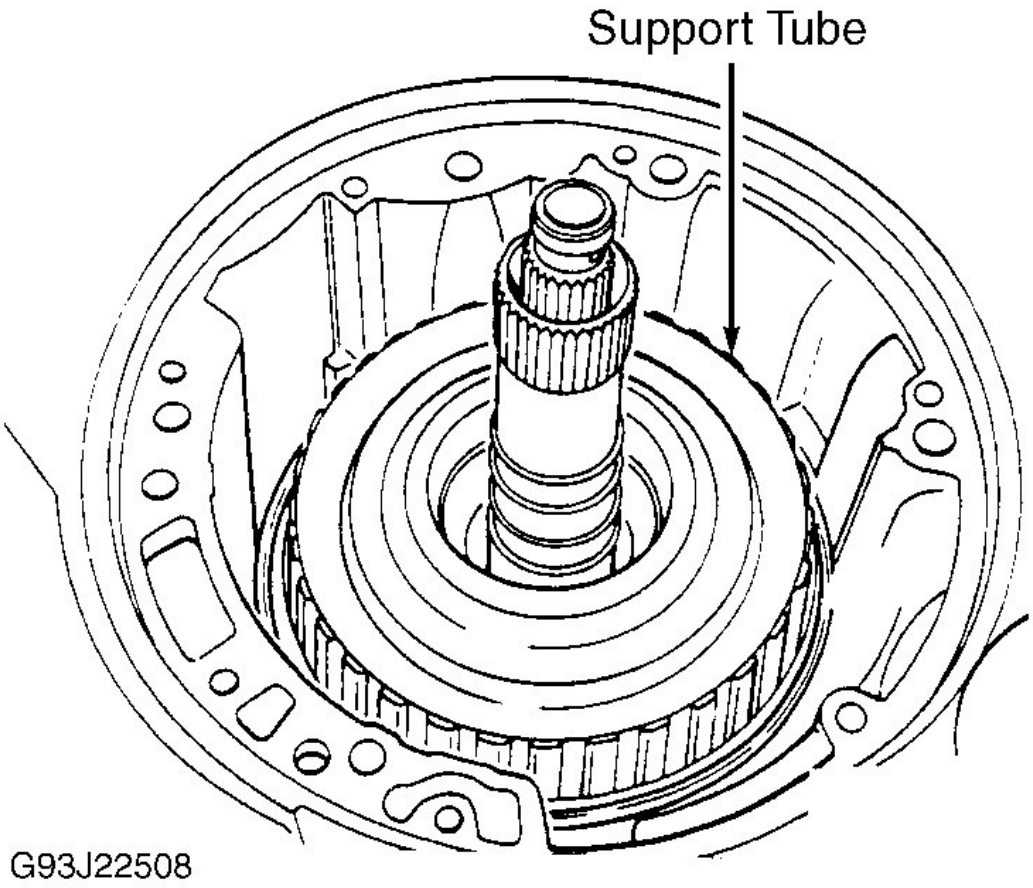

Fig. 76: Installing Support Tube
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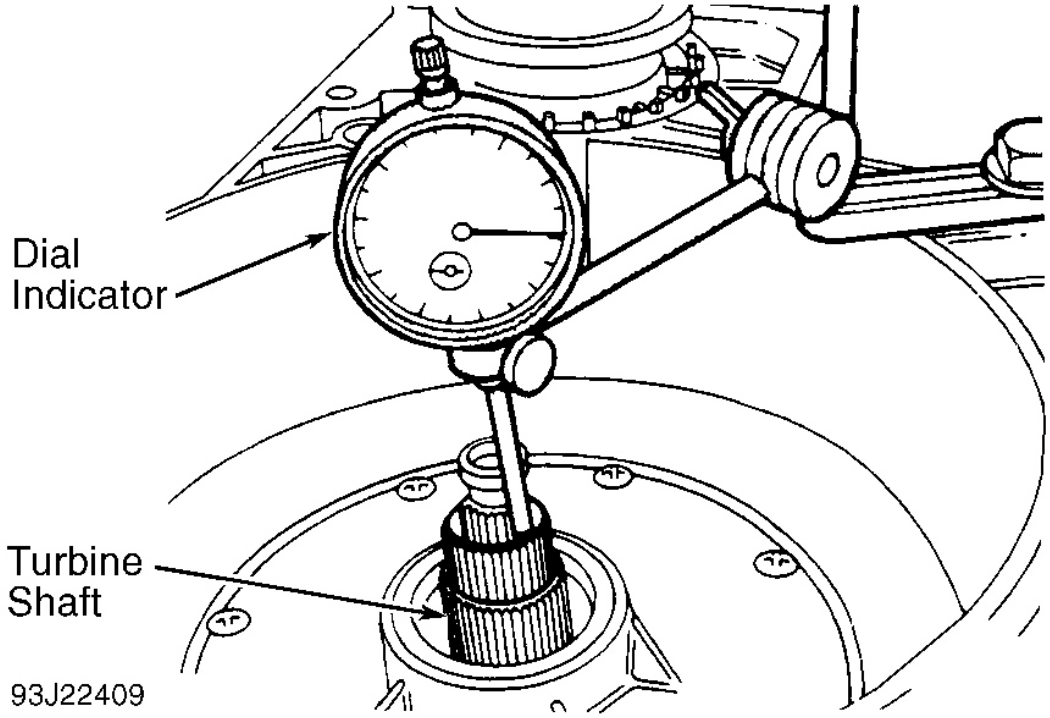

Fig. 77: Checking Turbine Shaft End Play
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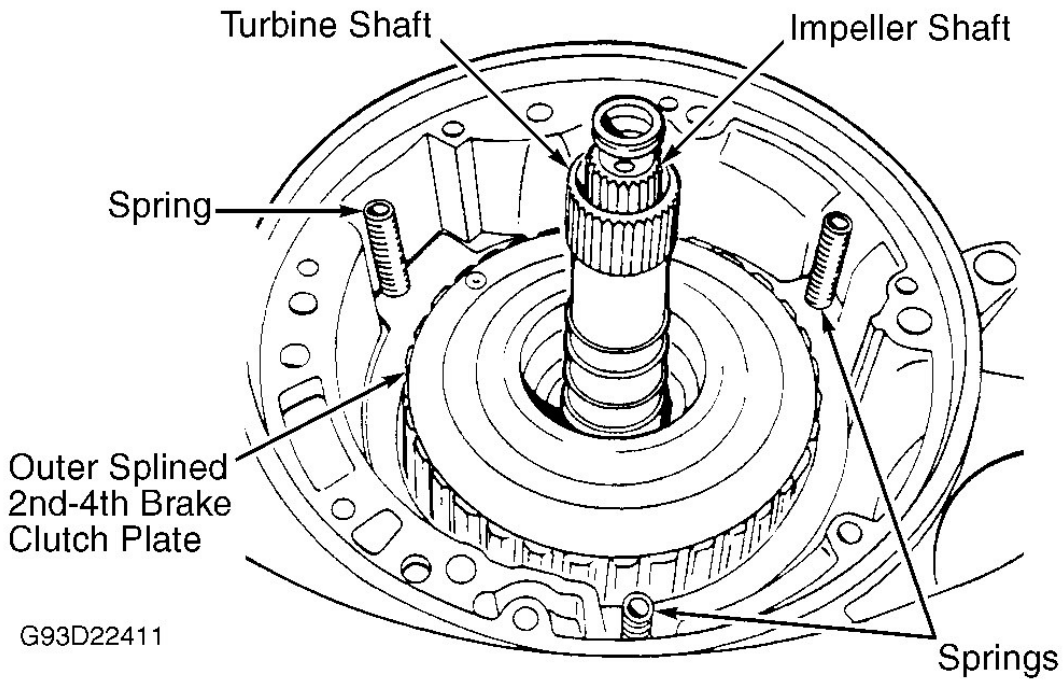

Fig. 78: Installing 2nd-4th Brake Clutch Plate & Springs
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13. Do not install top outer splined clutch plate or waved spring washer. Determine clearance of 2nd-4th brake clutch. Press 2nd-4th brake clutch assembly down. Using a depth gauge, measure distance from top of oil pump flange to 2nd-4th brake clutch (inner splined). See **Fig. 80** .
14. Place a straightedge across top of piston. Place gasket on oil pump flange. Using depth gauge, measure distance from straightedge to oil pump flange gasket. See **Fig. 81** . Subtract the thickness of the straightedge.
15. Subtract distance measured in step 13 from distance calculated in step 14 . This gives 2nd-4th brake clutch-to-piston distance.
16. Subtract .14" (3.6 mm) from value calculated in step 15 . This determines thickness of last outer splined 2nd-4th brake clutch plate. Outer splined 2nd-4th brake clutch plates are available in thickness ranging from .080-.148" (2.00-3.75 mm), in .010" (.25 mm) increments.
17. Install 3 spring caps and last outer 2nd-4th brake clutch plate. Install waved spring washer. Install oil pump gasket. Install "O" ring to oil pump, and install oil pump. Install cover for transfer gears.
18. Move gear change shaft to "P" position. Push manual valve operating lever with manual valve into valve body. Tighten set screw. Install sealing plug. See **Fig. 20** . Install valve body. Install oil filter screen and oil pan. See **Fig. 42** and **Fig. 82** -**Fig. 84** . Install the torque converter.

NOTE: Factory uses .14" (3.6 mm) value to allow for waved spring washer being installed with 2nd-4th brake clutch plates.

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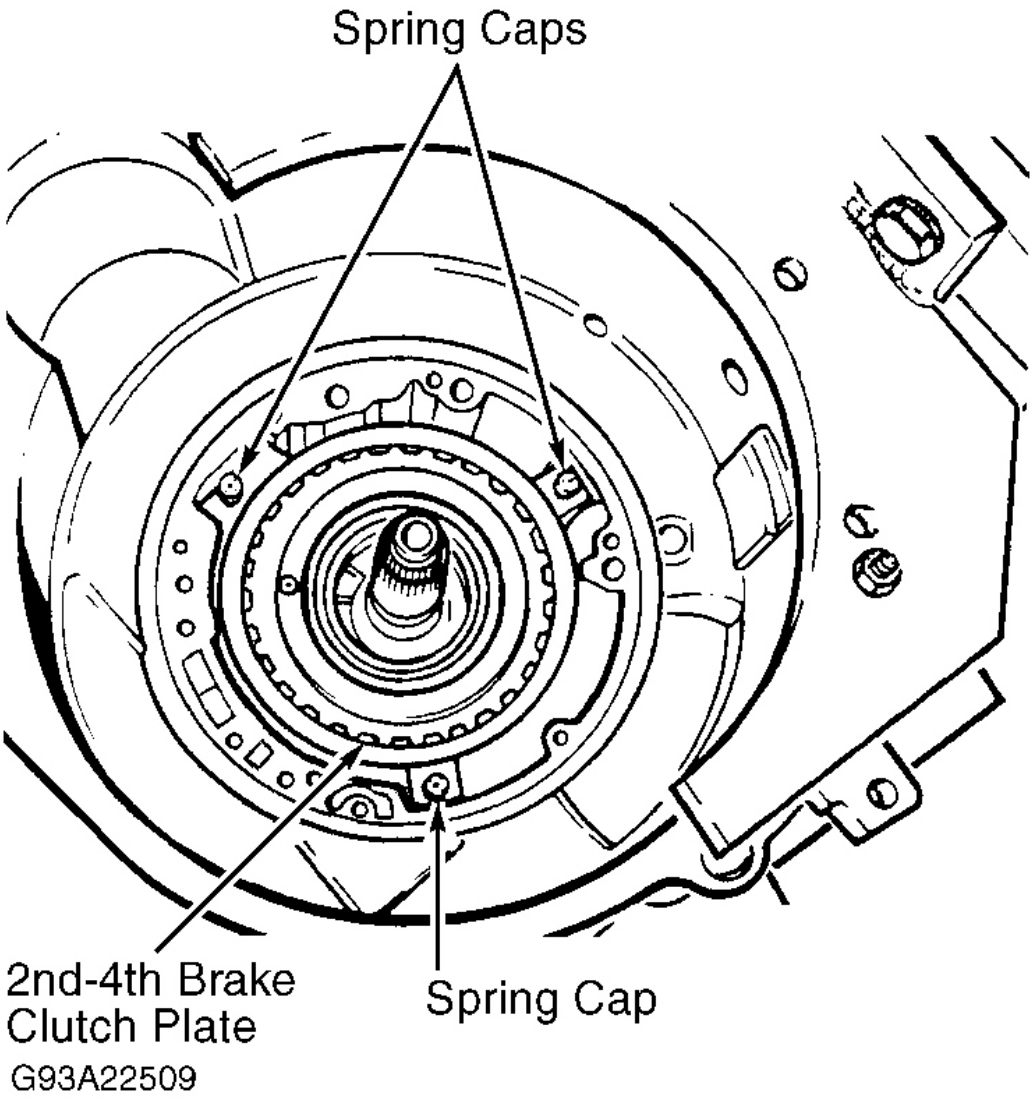

Fig. 79: Installing 2nd-4th Clutch Plates
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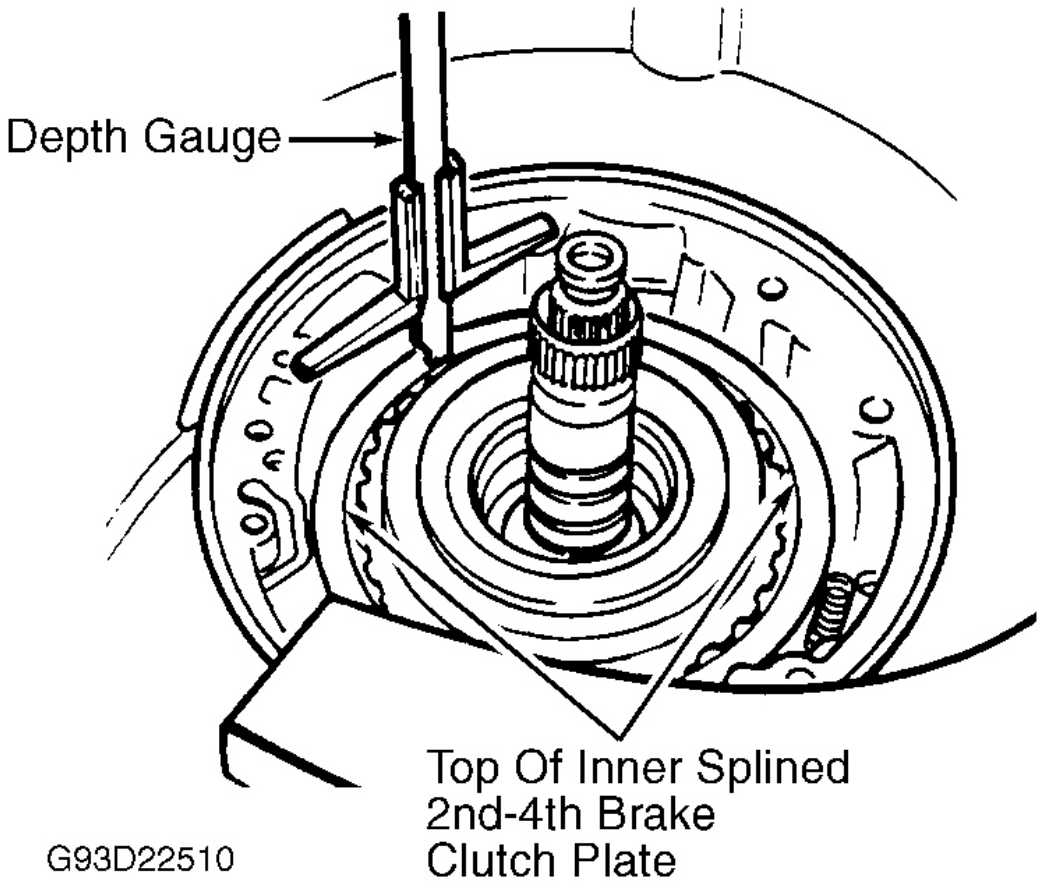

Fig. 80: Measuring Oil Pump Flange-To-Clutch Plate
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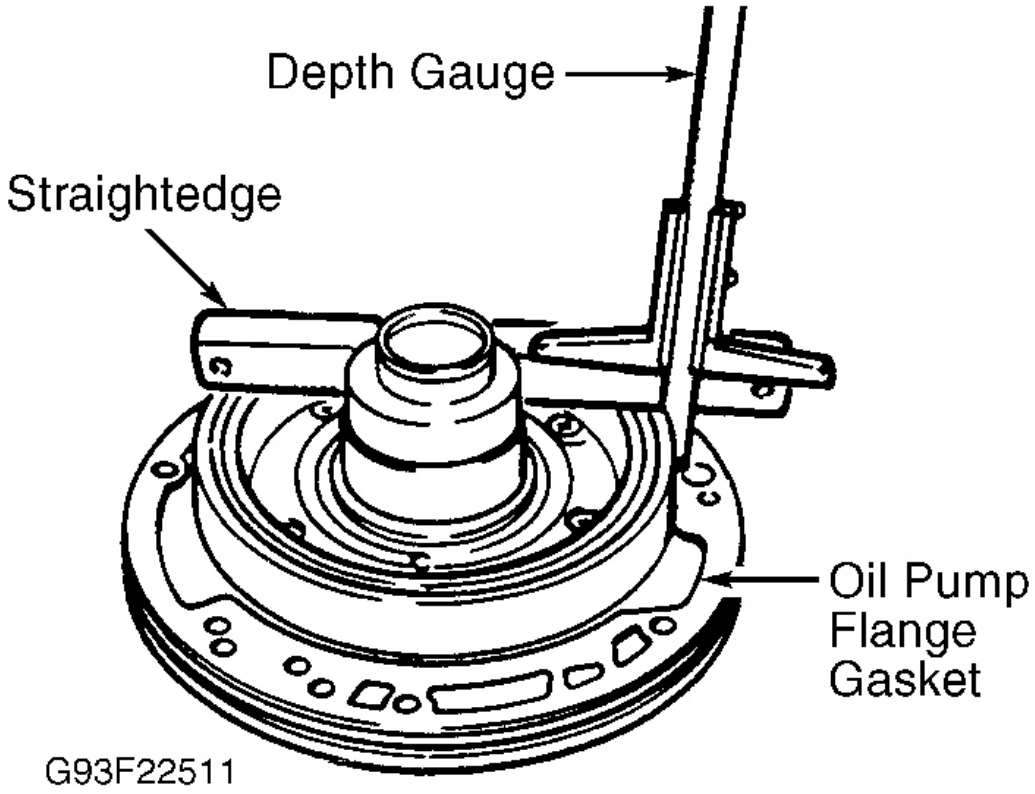

Fig. 81: Measuring Height Of Piston
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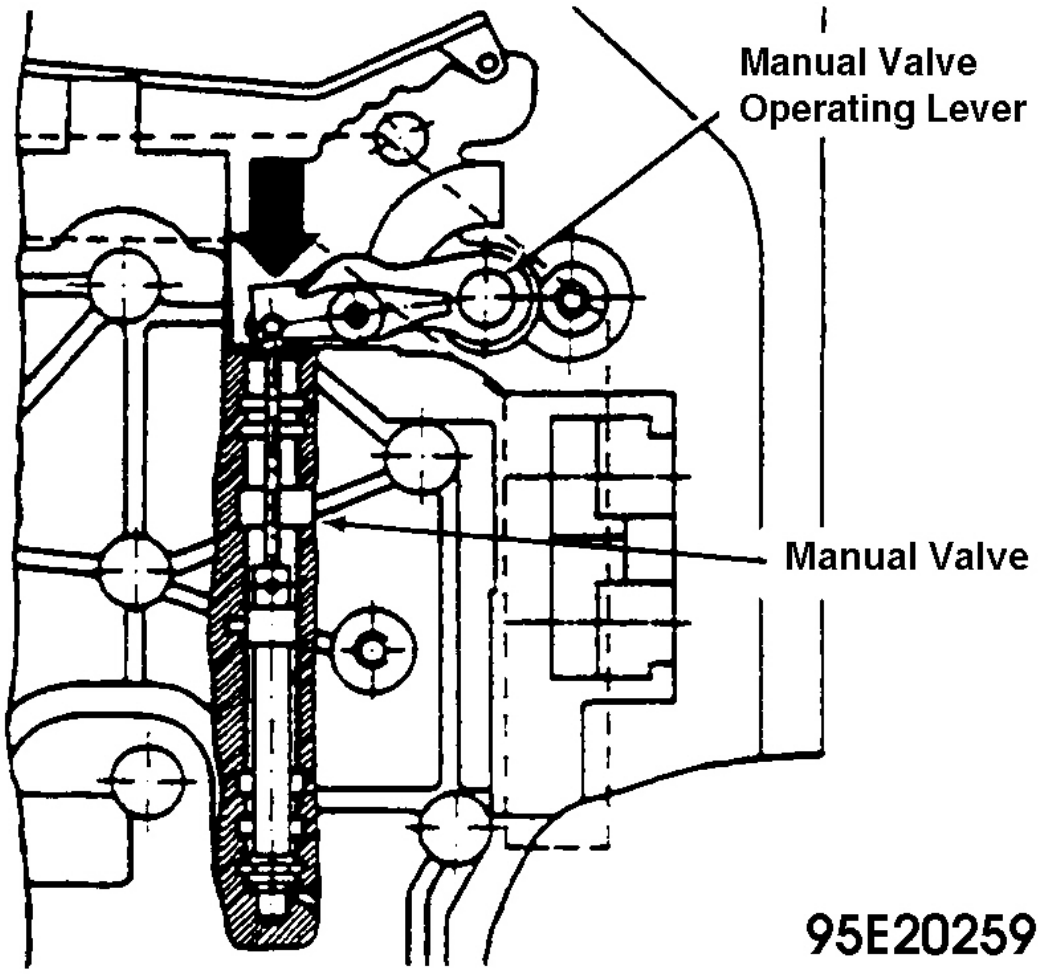

Fig. 82: Installing Manual Valve Operating Lever
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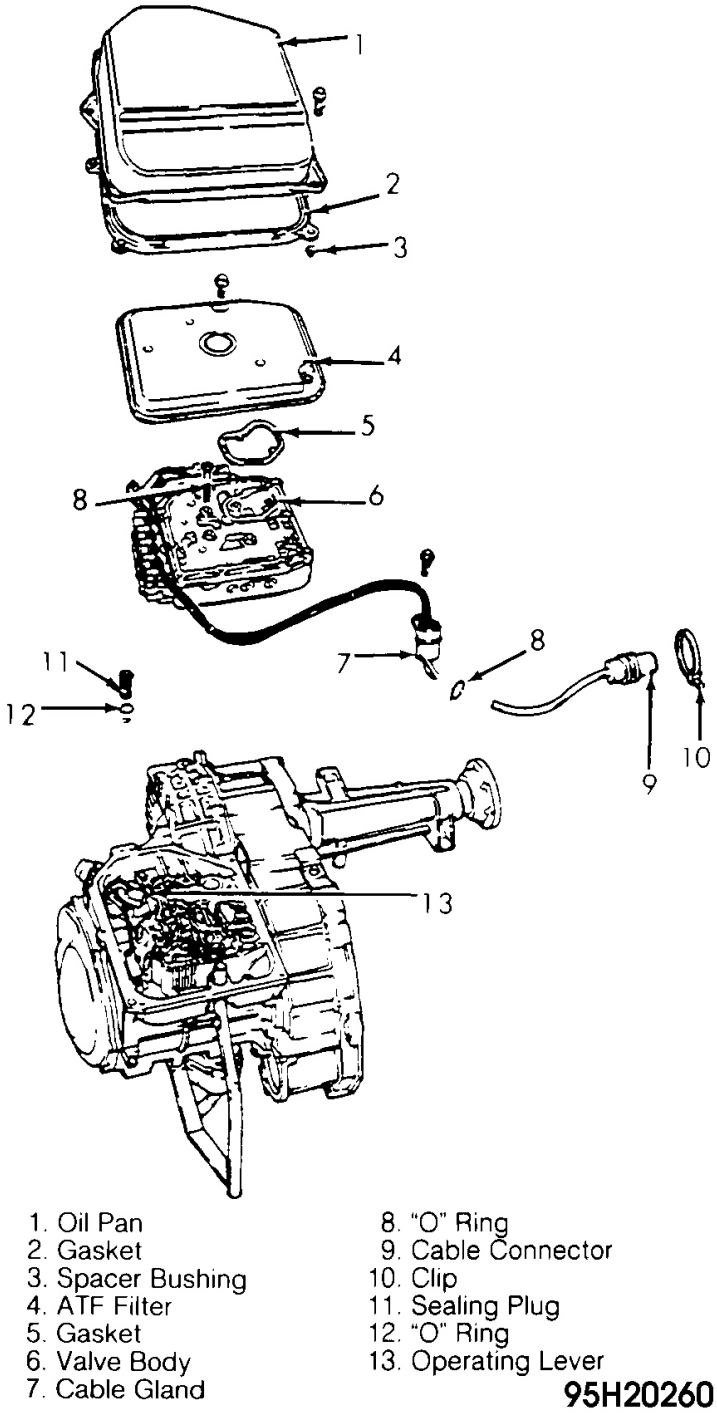

1. Oil Pan
2. Gasket
3. Spacer Bushing
4. ATF Filter
5. Gasket
6. Valve Body
7. Cable Gland
8. "O" Ring
9. Cable Connector
10. Clip
11. Sealing Plug
12. "O" Ring
13. Operating Lever

Fig. 83: Exploded View Valve Body & Components
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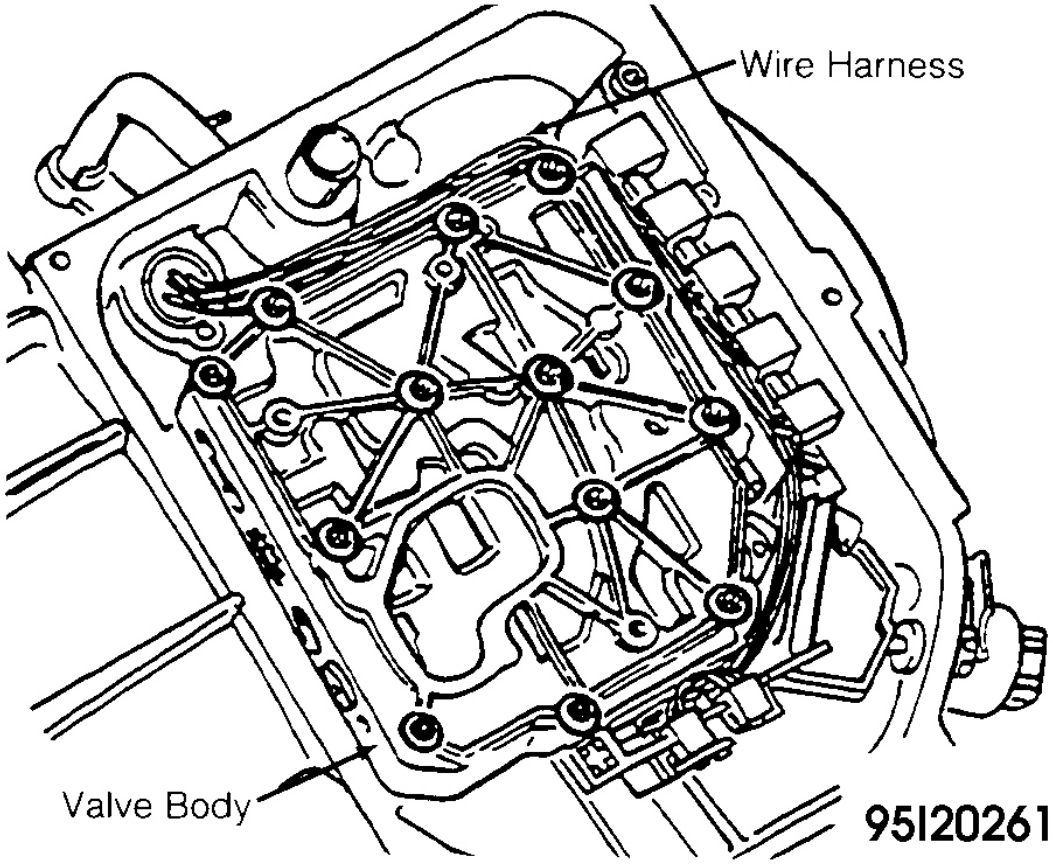

Fig. 84: Installing Valve Body
Courtesy of VOLKSWAGEN UNITED STATES, INC.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Ball Joint Bolt	26 (35)
Differential Bearing Carrier	110 (150)
Differential Housing Cover Bolts	21 (28)
Drive Axle Flange Bolts	33 (45)
Drive Pinion Bearing & "O" Ring Support	148 (200)
Drive Pinion Nut	185 (250)
Input Transfer Gear Nut	185 (250)
Oil Cooler Banjo Bolts	26 (35)
Small Planetary Drive Shaft Bolt	22 (30)
Subframe-To-Transaxle Support Nut	44 (60)

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Torque Converter Nuts	44 (60)
Transaxle-To-Engine Bolts	
10-mm Diameter	44 (60)
12-mm Diameter	59 (60)
Transaxle-To-Transaxle Support Bolts	44 (60)
	INCH Lbs. (N.m)
Detent Spring Screws	84 (10)
Differential Bearing Carrier/Adjuster Locking Tab Bolt	108 (12)
Oil Filter Bolts	71 (8)
Oil Pan Bolts	108 (12)
Oil Pump-To-Transaxle Bolts	71 (8) Plus 90°
Transfer Gear Cover Bolts	71 (8)
Valve Body Bolts	44 (5)

TRANSAXLE SPECIFICATIONS

TRANSAXLE SPECIFICATIONS

Application	**In. (mm)**
Clutch Clearance	
Apply Clutches	(1)
Brake Clutches	
2nd-4th	(2) .060-.068 (1.50-1.74)
Reverse	.047-.071 (1.2-1.8)
Gear & Shaft End Play	
Planetary Carrier	.009-.014 (.23-.37)
1st-3rd To Reverse Apply Clutch	.019-.047 (.50-1.20)
Turbine Shaft	.019-.047 (.50-1.20)

(1) Assembled clutch clearance is not available.

(2) See **TRANSAXLE** under TRANSAXLE REASSEMBLY.

TECHNICAL SERVICE BULLETINS

INCORRECT FINAL DRIVE FLUID 1993-94 098 (93-11, JUNE 15, 1993)

Ensure proper fluid is being used in final drive unit, premature failure may occur. Use SAE 75W/90 synthetic gear oil only.

WIRING DIAGRAMS

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Fig. 85: Transaxle Wiring Diagram (098)

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